PUBLIC WORKS

May
1959

CITY, COUNTY AND STATE

Solving
WATER and SEWERAGE
Problems of
County Urbanization
page 104

Testing Procedures for
BITUMINOUS CONCRETE
page 109

SAFETY
in Sewer Construction
and Maintenance
page 113

Experiences in
WASTE WATER RE-USE
page 117

Standard Plans for
HIGHWAY BRIDGES
page 130

AND MANY OTHER
VALUABLE ARTICLES
SEE PAGE 5

Albert E. Berry, one of the best known sanitary engineers in all North America, is Chief Engineer and General Manager, Ontario Water Resources Comm., with office in Toronto. More on page 18.

you can't beat a GALION.

ROLL-O-MATIC Rollers are designed to meet the ever-increasing tempo of job completion schedules on the national highway program. Write for literature.

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GENERAL AND EXPORT OFFICES GALION, OHIO, U.S.A.

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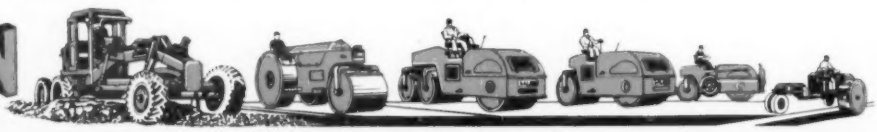

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. . . and provides top performance, stability and operating economy

NEW DESIGN . . . Chicago Pump Company's new Digester Pontoon Covers have been completely redesigned and engineered to incorporate the latest standards of structural design . . . providing the highest live load safety factor. This new cover also features reduced field erection time and cost . . . ballasting for operating gas pressures of 12 inches of water . . . purlins and top truss chords punched to permit nailing or bolting of rafters . . . parts marked for placement according to the shop drawings . . . design for erection outside the tank and swinging into place by cranes.

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Chicago Pump Company

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This is only one of many city jobs handled by the versatile Cat No. 955 Traxcavator

After loading the stockpiled fertilizer, this No. 955 Traxcavator at Burley, Idaho, may head for any number of jobs. Its next assignment may be to excavate pit run gravel for streets, root up unwanted trees, remove snow, dig trenches and drains, or dispose of garbage. It does them all quickly and does them well.

Whatever the job, the operator can see the work clearly—all around. Bucket controls are conveniently located for one-hand operation. And the exclusive Caterpillar Oil Clutch delivers up to 2,000 hours—a whole season—without adjustment.

The No. 955 is a high-production machine. Its 1½ cu. yd. bucket can be tilted backward a full 40° at ground level to pry a full load on every pass—even with hard-to-penetrate materials. Superintendent John Carroll describes the No. 955 this way: "... it's fast and has a lot of power. The bucket is full the minute you start to raise it. Others don't do that. It's a good piece of equipment." The operator says, "I like the controls better on this machine. The bucket comes right up and the machine is balanced. It doesn't tip forward when loaded."

All Traxcavators have been designed to give you high production on many kinds of jobs. New attachments and new improvements make them more versatile and valuable to you than before. Ask your local Caterpillar Dealer for up-to-date facts on Traxcavators. He'll show you how to get more production from every dollar you spend.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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NEW Improved track links for greater strength and longer wear now are standard on the No. 955 Series E Traxcavator. Stronger, more rugged—for longer track link life . . . lower maintenance costs.

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

MAY 1959 • VOLUME 90, NUMBER 5

Street Lighting Paces City Modernization 101
Business district lighting program expanded to include street widening and resurfacing plus new shopping area lights. BENTON R. ANDERSON

Solving the Water and Sewerage Problems of County Urbanization 104
County acts as coordinating agency between 13 incorporated cities and other communities to provide water, sewerage and storm drainage. H. G. CROWLE

Refuse Collection and Disposal Operated at a Profit .. 108
Stockton, Calif., consistently shows a profit in 17 years of operation. H. H. BECKER

Bituminous Concrete Plant Inspection 109
Well-equipped inspection teams check design of all bituminous concrete used by the Ohio State Highway Department. F. M. WILLIAMS

Safety in Sewer Construction and Maintenance 113
A review of hazards encountered by workmen, recognized safety practices and equipment used to minimize accidents. LEROY W. VAN KLEECK

The Re-Use of Treated Waste Water for Domestic Purposes 117
Experiences in recycling sewage effluents and a discussion of the sanitary and esthetic considerations involved. DWIGHT F. METZLER

100-Lane Expressway for Public Works Communications 120
The author discusses factors involved in 2-way radio selection, cost of the system, licensing and maintenance. LEO SANDS

Sanitary Engineering and Industrial Waste Treatment 124
How the qualifications of the sanitary engineer make him well suited to handle any liquid industrial waste product. E. B. BESSELIEVRE

Two Centuries of Water Works Progress 126
Bethlehem, Pa., which boasts the first public system with pumped water, now has a $29 million plant and plans future expansion. H. R. FRANTZ

Street Cleaning in a Residential Community 129
How Arlington County, Va., handles cleaning operations on 354 miles of streets. F. H. DOE, JR.

Standard Plans for Bridges 130
Reports from eight State Highway Departments show progress in standardization of bridge plans.

Purchasing at the State Level 132
A review of equipment procurement policies in the Ohio Department of Highways. PAUL E. BOYER

Parkway Lighting Will Enhance Miami's "21-Nation" Garden 133

Modernizing a Municipal Auditorium 134
Complete remodeling makes Birmingham's auditorium suitable for many events. FRED MCCALLUM

Leaf Collection Requires Adequate Equipment 135
Faster, neater collections help solve the burden of leaf removal. RUDY RIFE

O.R.P. and Sewage Treatment 136
The fundamental concepts involved in applying oxidation-reduction potential measurement to the control of treatment. JOHN W. HOOD

Cost of Operation of Road Machinery 162

Changing Patterns in Pesticides 186

Use of Highway Embankments for Water Impoundment 190
How efforts of highway departments and conservation agencies can be coordinated. G. M. WILLIAMS

Financing and Planning Federal-Aid Highways in Metropolitan Areas 196
Michigan cities and counties participate in state and federal programs ALFRED BERARDUCCI

Steel Buildings Used in Park and Forestry Departments 201
Low-cost steel buildings meet many storage needs for these county agencies. C. F. MARTIN

George Washington Bridge Will Have a Lower Level 202

Lagoons and Prefabricated Lift Station Used in Sewage Treatment 204
How sewage disposal facilities were installed by city forces in Lamar, Colo. G. H. RUSSELL

PUBLIC WORKS DIGESTS:
- Sewerage and Refuse 152
- Highways and Airports 164
- Water Works 178
- Industrial Wastes 192

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DEPARTMENTS AND SECTIONS

The Editor's Page 7
Leader in Public Works 18
Books in Brief 22
Reviews of Catalogs 34
Legal Notes 62
Letters to the Editor 74
Commentary on Water and Sewage Treatment 90
Municipal Power 141
Equipment News 211
Worth Selling 219
Worth Telling 220

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BPA

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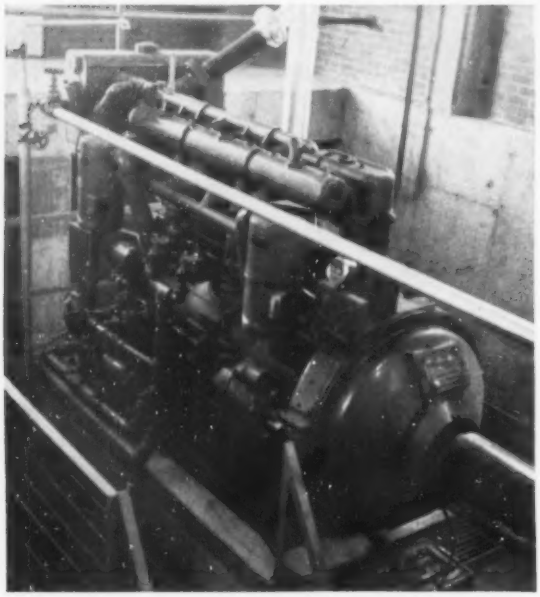
ROILINE ENGINES (Formerly LE ROI)

* The trade mark LE ROI is used under license from Westinghouse Airbrake Co., the trade mark owner.

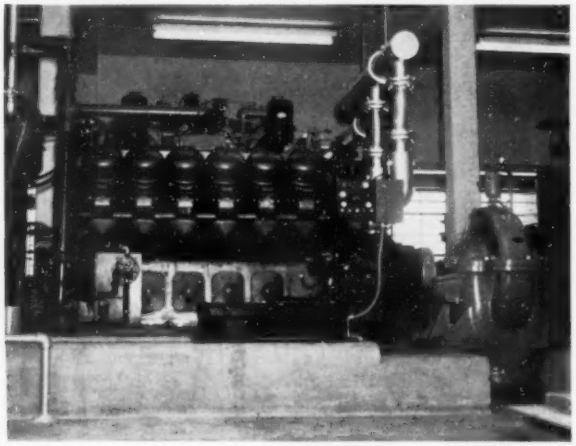
POWER FOR MUNICIPAL PLANTS

Three ROILINES pull the pumps at Oklahoma City's Lake Hefner Municipal Filtration Plant.



Model F-1500, maximum horsepower 215 at 1200 rpm on natural gas.

Model L-3460, maximum horsepower 595 at 1350 rpm on natural gas.



BASIC ENGINE CHARACTERISTICS*

GASOLINE OR NATURAL GAS					600	800	1000	1200	1400	1600	1800	2000	2200	2400
MODEL	Bore & S.	Cyls.	Displ.	Torque–rpm	BRAKE HORSEPOWER AT ENGINE SPEEDS INDICATED									
H540	4½ x 4¼	8	540	430- 900	. . .	64	82	99	115	130	143	155	164	170
H844	5¼ x 4⅞	8	844	637-1500	. . .	106	135	165	191	215	237	255	270	278
F1500	6¾ x 7	6	1503	1090- 650	125	165	200	215						
H2000	6¾ x 7	8	2004	1485- 650	170	225	270	290						
L3000	6¾ x 7	12	3006	2200- 650	250	335	405	435						
L3460	7¼ x 7	12	3468	2570- 900	285	391	492	568	595 @ 1350 RPM					
L4000	7.54 x 7.5	12	4000	2930- 900	325	446	560	645						

*With oil pump, water pump, magneto, air cleaner, carburetor, and exhaust muffler. Hp shown is maximum.

SEE YOUR ROILINE ENGINE DISTRIBUTOR

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CALIFORNIA, Long Beach, Engine & Equipment Company
COLORADO, Denver, Emrick & Hill Engine & Equipt. Co.
ILLINOIS, Centralia, John Nickell Company
KANSAS, Garden City, Carson Machine & Supply Co.
LOUISIANA, Shreveport, Ingersoll Corporation
MICHIGAN, Reed City, Hafer Engine Company
OHIO, Columbus 19, Cantwell Machinery Company
OKLAHOMA, Chickasha, Chickasha Gin & Mill Supplies
Oklahoma City 9, Carson Machine & Supply Co.
PENNSYLVANIA, Pittsburgh 34, P. C. McKenzie Company
TEXAS, Houston 1, Southern Engine & Pump Co.
Lubbock, Farmers Supply Company
Odessa, General Machine & Supply Co.
Wichita Falls, Nortex Engine & Equipment Co.
WYOMING, Casper, Emrick & Hill Engine & Equipt. Co.

424

WAUKESHA MOTOR COMPANY • Waukesha, Wisconsin **NEW YORK • TULSA • LOS ANGELES**
Factories: Waukesha, Wisconsin and Clinton, Iowa

Wires, The Air Waves and Public Works Activities and Needs

MORE AND more public works activities are bound together by wires and by air waves as automation and two-way radio permit more efficient and effective operation. Recent developments include a new radio channel for public service operations which should encourage a wider use of short wave system applicable to water, sewerage, street and refuse collection work. The advantages of instant communication as a means to faster service with fewer waste motions is widely recognized.

In the automation field, wires can do what once took manpower, automobiles and travel time. The control of pumping at remote places, reports of routine operations and the ability to control many procedures from a single small central office may save money and personnel while resulting in more efficient performance.

Every branch of city or county government should look into these developments if they have not already done so. The opportunities for better service are almost unlimited.

Package Plants for Small Sewage Treatment Jobs Can Solve Many Problems

ORGANIZED COMMUNITIES can employ skilled engineers to solve their sewage treatment problems. The individual householder can usually find someone to install a septic tank or cesspool which, provided ground conditions are not too unfavorable, will give quite good service.

The in-between jobs have been and still are problems—the supermarket beyond the sewer lines, the restaurant in the country and the rural school, to mention only three. The capable consulting engineer cannot afford to design a plant for such places because the fee he can expect will not cover his actual costs of doing the job.

There have been some excellent package plants in use for some years and more are becoming available. In the past, State Sanitary Engineers have been slow to recognize them as solutions to difficult problems and some states have practically barred their use. We think this is a mistake. Granted that small plants present operating problems, the solution does not seem to be prohibition of their use, but rather a reorientation of health services, or even a reorganization, if necessary, to provide the operational and supervisory skills necessary for them to do the jobs that need seriously to be done.

Good Engineering is Needed More Than Ever For the Future

THE PATTERN for the future is, as usual, not very clear and no one quite knows what we will face in population growth, water needs, and highway facilities a score of years from now. Guessing wrong can be very costly, so good engineering is needed to provide enough, yet not too much; to permit easy addition, enlargement or extension; to select water sources or highway routes that will serve future expanded populations; and to do all of this at a reasonable cost. The abilities and skills needed can best be found by a careful analysis of the background, training and past performance of the engineer. This applies whether retaining a consultant or employing a staff engineer. The bidding process has no place in selection, in either case. Not many cities would put up the position of city enginer to the lowest bidder, but that would be as sensible as to hire a consultant by the same process.

When Twenty Complain It May Be Time for a New Idea

DURING ONE of our late eastern snowstorms your editor went out to protest mildly to the snow plow driver about that third windrow across the driveway (after shoveling out the first two). Said the plow man: "Look, Mister, you are exactly the twentieth man to mention that tonight. I wouldn't do it to you if I could help it."

If twenty persons complained, maybe it is time the men in charge of snow removal took a hard look at what they are doing. It is disappointing to provide a service so essential as snow removal and benefiting so many people while receiving small praise and many complaints for doing it. It can be erosive to the morale of the men who work on the plows for long hours under rugged and disagreeable circumstances; and it can be equally hard on the men who plan and direct the work. Perhaps the time has come when a broad study of possibilities of doing it better should be made. Few taxpayers will complain over being plowed in on the first go-around; it is the repetition that hurts and maybe that can be avoided.

Design of the Huber-Warco 8-12 ton tandem permits the unit to compact base gravel close to steel forms.

H-W Units at work on Erie

Handling the compaction work for Johnson, Drake & Piper on project FAET-564 on the new Erie Thruway were three Huber-Warco rollers—two 10 ton 3-wheels and an 8-12 ton tandem.

Known as the West Seneca project, it involved 4.19 miles of pavement including interchanges, and seven bridges.

On this job the Huber-Warco rollers compacted one and a half million yards of dirt, about 10,000 yards of bank-run stone, and 32,000 yards of foundation course gravel for the road bed.

For rolling inside the steel forms, Johnson, Drake & Piper used their Huber-Warco tandem. The roller followed directly behind the form grader. The design of this Huber-Warco tandem enabled the operator to compact the material right up to the forms. The extra operator visibility and ease of steering helped simplify the job throughout the many hours of precision work.

Huber-Warco tandem and 3-wheel rollers offer many distinct advantages that add up to more efficient and economical rolling. They each offer a torque converter and two-speed transmission. In addition, these units feature a tail-shaft governor. Within close limits, this tail-shaft governor maintains the rolling speed set by the operator, regardless of the grade.

Another important feature is a completely adjustable guide roll assembly that eliminates road "scuff" caused by looseness. Easy adjustment makes it possible to keep the guide roll assembly in factory-perfect

Huber-Warco Company

MARION, OHIO

Huber-Warco on the job

Huber-Warco tandems and 3-wheels handle compaction assignments for Johnson, Drake & Piper on New York's Erie Thruway project.

Thruway

alignment for the life of the roller.

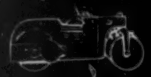
In the Huber-Warco 3-wheel roller line both standard and variable weight rolls are available in a range of from 10 to 14 tons. The tandem line consists of seven models ranging from 3-5 to 10-14 ton.

Your Huber-Warco distributor can give you specifications on the Huber-Warco tandem and 3-wheel roller line. Contact him soon and be ready for smoother, more profitable rolling operations.

Torque converter and 2-speed transmission add to efficient compaction by this Huber-Warco 10-ton 3-wheel roller.

Terms up to 36 months and rentals available . . . contact your Huber-Warco distributor.

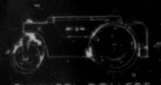
HUBER W WARCO



TANDEM ROLLERS

MOTOR GRADERS

MAINTAINER



3 WHEEL ROLLERS

PLAN FOR ACTION PROMOTES ADEQUATE WATER SUPPLY

Here's help you can count on

On the opposite page is the third in the current series of advertisements created as a public service by the Cast Iron Pipe Research Association. It's aimed straight at Mr. and Mrs. America through the pages of the widely read *Reader's Digest* magazine.

Similar advertising appears regularly in *U. S. News & World Report, Nation's Business, Better Homes and Gardens, American Home* and *Sunset* magazines.

Every advertisement dramatizes the importance of pure, safe water for home and industry and emphasizes the growing seriousness of the water supply problem. Furthermore, these advertisements *give the reader something to do about it.*

Free Plan-for-Action Booklet

Every reader is offered a free booklet (illustrated on the opposite page) which describes ways for them to get the facts about the water situation in their own communities. A step-by-step outline of action is presented so that, armed with the facts, local citizens can get behind a broad program for extending and improving water service in their own areas.

The third item of assistance offered by the Cast Iron Pipe Research Association to those in the water supply field is a community relations portfolio, also illustrated opposite. It contains ideas and suggestions for public officials to use in their own community relations activities to bring adequate supplies of water to homes and industry in their towns. It tells how informed citizens and officials can work together for improved facilities and adequate rate structures or financing.

This program is already at work—for you. Its impact will be felt more and more as the months go by. For more information and a copy of the booklet, "Water—make sure you'll always have plenty," write to Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

THREE REASONS WHY CAST IRON PIPE IS *AMERICA'S GREATEST WATER CARRIER:*

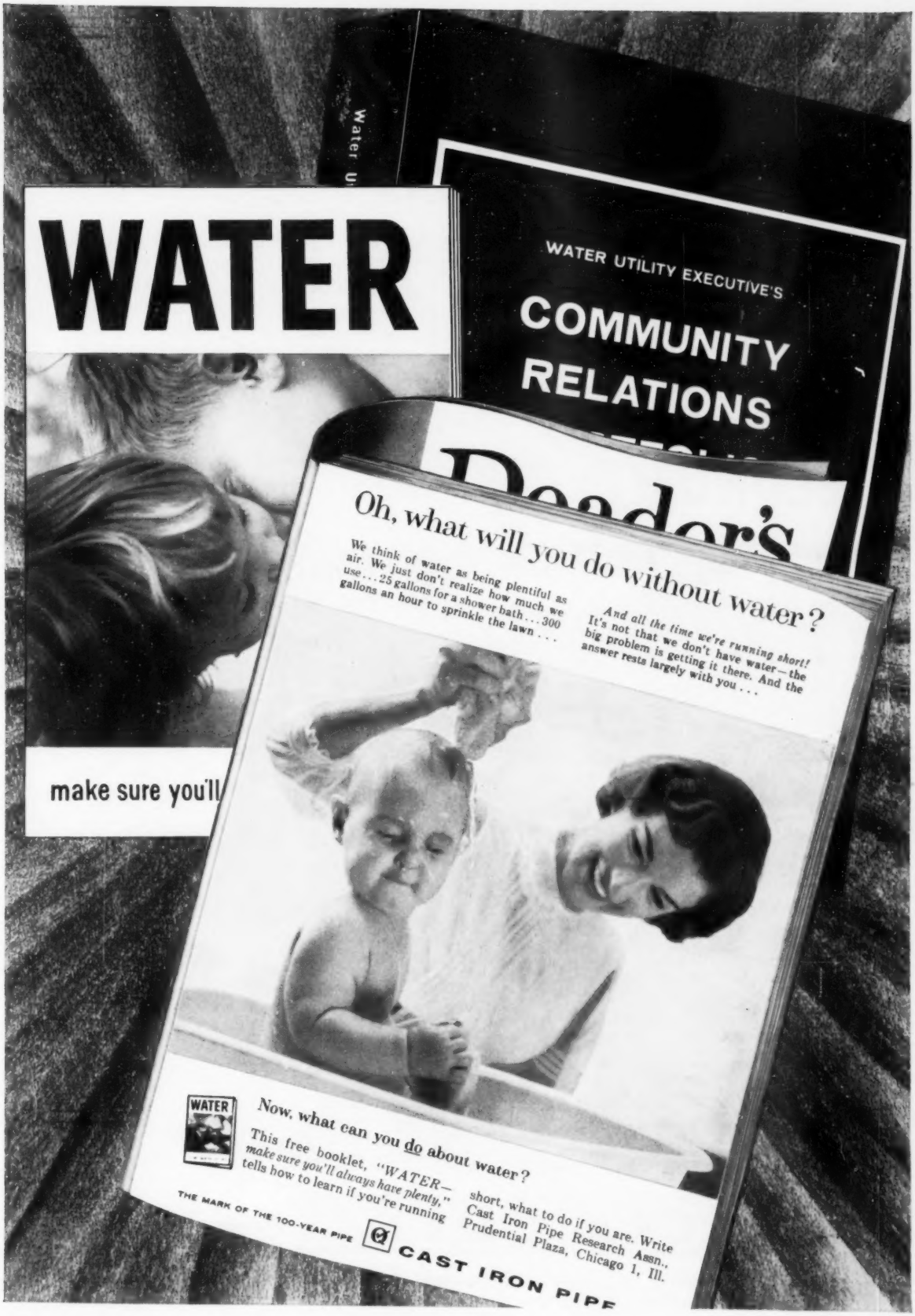
1. More miles of underground cast iron water mains are now in use than of all other kinds of pipe combined.

2. More miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.

3. Impartial surveys prove that today's water utility officials and consulting engineers prefer cast iron pipe for underground water distribution by an overwhelming majority.

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE


WATER
make sure you'll
WATER UTILITY EXECUTIVE'S
COMMUNITY
RELATIONS
Oh, what will you do without water?
We think of water as being plentiful as air. We just don't realize how much we use... 25 gallons for a shower bath... 300 gallons an hour to sprinkle the lawn...
And all the time we're running short! It's not that we don't have water—the big problem is getting it there. And the answer rests largely with you...
Now, what can you do about water?
This free booklet, "WATER—make sure you'll always have plenty," tells how to learn if you're running short, what to do if you are. Write Cast Iron Pipe Research Assn., Prudential Plaza, Chicago 1, Ill.
THE MARK OF THE 100-YEAR PIPE
CAST IRON PIPE

Your city's sewerage system... NO PLACE FOR FALSE ECONOMY!

Economizing with substitute pipe has been a costly mistake in far too many instances of public record. Such mistakes may be hidden . . . but not for long. And when failure does occur, the danger and inconvenience of disrupted service and the cost of repair and replacement far outweigh any initial savings.

The surest way to avoid such mistakes is to insist on Vitrified Clay Pipe for use in your city's sewerage system. Clay Pipe does not rust, rot, corrode, or disintegrate. Its smooth vitrified surface assures better flow . . . provides trouble-free operation at rated capacities. And longer, stronger Clay Pipe with factory-made compression joints not only stops infiltration and roots, but cuts installation costs too. Clay Pipe never wears out!

Only Clay Pipe has *all* the features you can trust for years and years and years.

C-459-2A

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia

94-inch cut (Model HR8-1) on the 61 hp* Six-cylinder Farmall® 460 tractor with gasoline, diesel or LP Gas engine—built for highest capacity under the toughest conditions!

INTERNATIONAL Dango

heavy-duty center-mounted rotary mowers...

more miles of rugged mowing per day!

Center mounting lowers the center of gravity, lets you work on steep slopes where others can't go. Operator rides *above* the blades for maximum safety; special chain shields hug uneven terrain, eliminating danger to passing traffic from thrown objects. Overlapping, triple-blade design lets you mulch-mow anything from finest turf to heavy brush—even small saplings. With non-wrapping spindles, mow non-stop in dew-damp or rain-wet growth—save hours and hours of down-time!

Four sizes: 58, 60, 66, and 94 inches on traditionally-tough IH tractors, 13.4, 38.5, 45, and 61 hp*. A nearby IH Dealer will demonstrate. For his name, and specification sheets write International Harvester Co., P.O. Box 7333, Chicago 80, Illinois.

**Maximum flywheel hp at standard sea level conditions.*

60-inch cut (Model C-I) for 13.4* IH Cub® tractors is an exceptionally low-cost combination for mowing steep slopes, roadside parks, playgrounds, and similar areas.

See your

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International Harvester Products ***pay for themselves in use*** —Farm Tractors and Equipment . . . Twine . . . Commercial Wheel Tractors . . . Motor Trucks . . . Construction Equipment—General Office, Chicago 1, Illinois

DOW | CALCIUM CHLORIDE

SETTLE THAT DUST . . . cut road maintenance, too, with Dow calcium chloride

Farmers, housewives, motorists—in fact, anyone living on or near unpaved roads continually fights a dust problem. That is, unless the roads are being treated with Dow calcium chloride to keep dust in its place.

By attracting more than its own weight in moisture, Dow calcium chloride dampens the roadbed, settles dust. Both Dowflake®, the 77-80% flake type, and Peladow®, the 94-97% concentrated pellet type, are easy and economical to spread . . . can be applied dry or in a water solution. One application compacts road surfaces for many weeks.

Dowflake and Peladow save in road maintenance too! Engineers estimate that untreated roads lose about 200 cubic yards of aggregate per mile in a year; while calcium chloride treated roads show an average loss of *only 25 cubic yards!* Thus the binding effect of Dow calcium chloride reduces gravel loss and blading costs by *as much as 80%!*

Settle dust problems the easy, economical way by using Dow calcium chloride! Dow's Highway and Construction Materials Engineers will be glad to help you with information or engineering counsel.

For local assistance | Write THE DOW CHEMICAL COMPANY, CC400EC5, Midland, Michigan

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

Tapping Water Lines Under Pressure

American Concrete Cylinder Pipe can be tapped with ease and economy while still under pressure.

The sudden explosive growth of many communities in the west has made it difficult for the best of advance planners to achieve both economy and adequate service in water supply systems designed for the future.

The possibility of unpredictable requirements for service outlets was one of the factors taken into consideration in the design of American Concrete Cylinder Pipe. Without de-watering the pipeline, small or large diameter outlets can be easily installed by any water works service group using standard tapping equipment. New outlying areas which mushroom in the typical western growth pattern can be readily integrated into a planned system if American Concrete Cylinder Pipe is used for the transmission lines.

American PIPE AND CONSTRUCTION CO.

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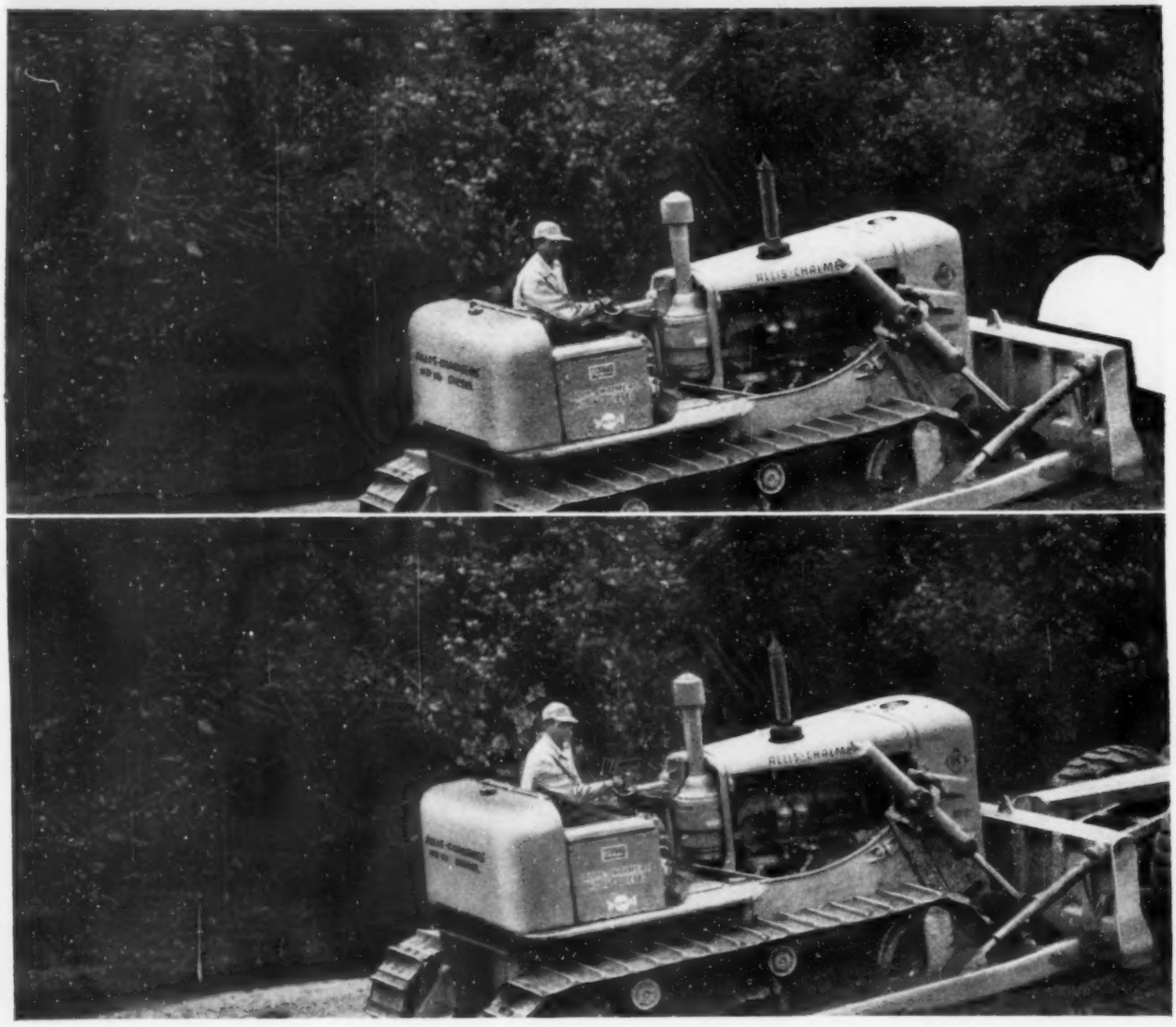
HAYWARD: P. O. Box 630 — JEfferson 7-2072
SAN DIEGO: P. O. Box 13 — CYpress 6-6166
PORTLAND: 518 N. E. Columbia Blvd.— BUtler 5-2531
ALBUQUERQUE: P. O. Box 1782 — CHapel 7-0486
PHOENIX: American Concrete Pipe Co. (Subsidiary) P. O. Box 12127 — ALpine 2-7566

CONCRETE PIPE FOR MAIN WATER SUPPLY LINES, STORM AND SANITARY SEWERS, SUBAQUEOUS LINES

Same cut . . . same pusher
5% more dirt in 42% less time

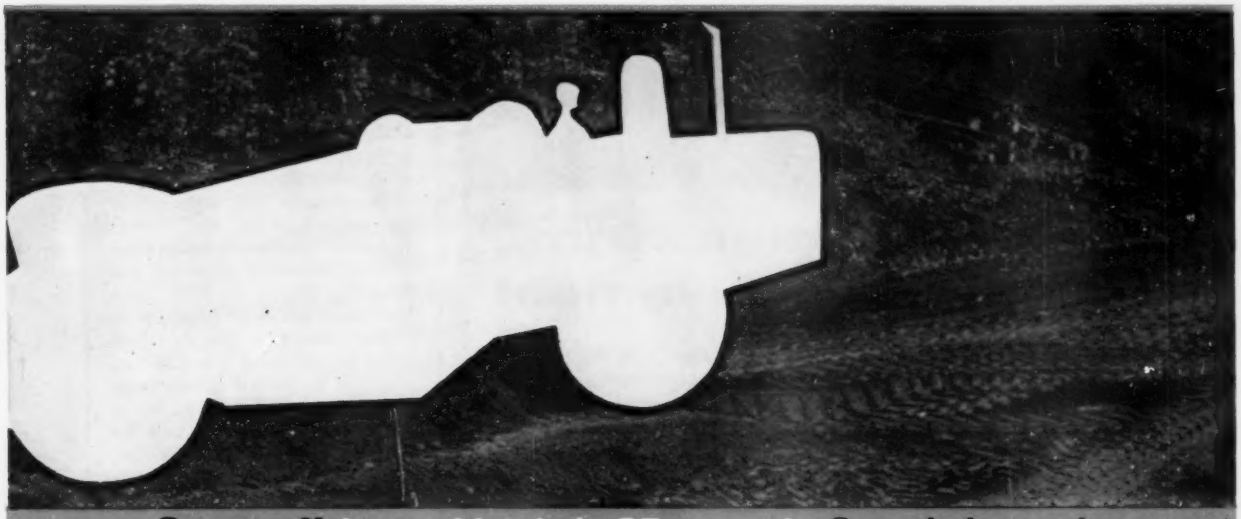


You may be surprised . . . may even challenge these facts. But facts they are, and we invite you to check them on *your* job, with *your* stop watch. Call your nearby Allis-Chalmers dealer now. He'll provide the TS-160 . . . when and where you say. *Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.*

.....move ahead with ALLIS-CHALMERS...

DAY IN...DAY OUT, THIS ALLIS-CHALMERS 9½-YARD TS-160 OUTWORKS ITS LEADING COMPETITOR...AND DELIGHTS ITS OWNER*

This is no demonstration setup. It's a road job* where these two self-propelled scrapers worked every day . . . push-loaded by the same Allis-Chalmers HD-16 torque converter tractor. That made every loading cycle about as identical as they'll ever get. And hour after hour, the TS-160 moved out of the cut with a heaped load in an average of 42% less time than its 9-yard companion of another make. *This is extra work power you can turn into more production!*



Scraper X, heaped loads in 35 seconds, 9 yards heaped

TS-160, heaped loads in 20 seconds, 9½ yards heaped

* Further details on request

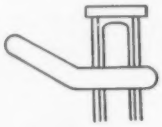
A-C ALLIS-CHALMERS

power for a growing world

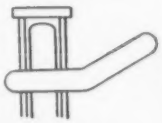
Cleveland "J" digs 20'/m through scored pavement

This Cleveland J-20, digging for 4 and 6-inch pipe on a Colorado utilities job, averaged 20 feet per minute as it cut through scored pavement and 8 inches of frost. Note the clean neat cut through paving and frost. Contractor's report indicates he was particularly pleased with the J-20's easy maneuverability as well as its high production on this job. *All* operations of the J-20 are controlled at the operator's seat.

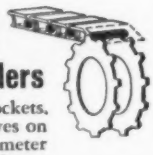
V Conveyor
...permits faster, higher spoil discharge, higher heaped loads without clogging.



Hydraulic Conveyor Shift
...permits digging past poles, trees, etc., without interrupting other operations.



Independent Hydraulic Drive
...controls conveyor speeds and direction of discharge.



World's Finest Trencher Crawlers
...double flanged sprockets, wheels, rollers...drives on each end of 1½" diameter hardened pins...eliminates plugging...sealed ball and roller bearings...1,000-hour lubrication...a tremendously long-lived, easy-rolling track.

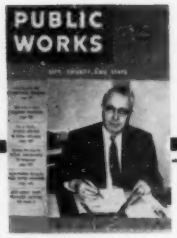
Hydraulic Crumbing Shoe
...optional, extra... pivots upward... allows setting wheel to required depth at walks, drives, underground obstructions.

Get Bulletin L-104 on Cleveland "J" trenchers from your local distributor ...or write:

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere



Albert Edward Berry is general manager and chief engineer of the Ontario Water Resources Commission, a position he has held since the organization of the Commission in 1956. He was born at St. Mary's, Ontario, in 1897, graduated with honors from the Faculty of Applied Science, University of Toronto, in 1917, after which he served with the Royal Canadian Engineers in the first World War. He obtained his Master's degree in 1921, and his Doctorate — Philosophy in Public Health—came in 1926. Prior to obtaining the last two degrees, he joined the Ontario Department of Health as a sanitary engineer. In 1926 he was appointed Director of that Department's Division of Sanitary Engineering, in which position he served for 30 years.

Dr. Berry has been secretary-treasurer of the Canadian Section of the AWWA and the Canadian Institute of Sewage and Sanitation since the early thirties. He has been president of the Federation of Sewage and Industrial Wastes Associations, of the Fuller Award Society, and of the AWWA; and vice-president of the Engineering Institute of Canada. At present he is chairman of the Pollution Control Board of Ontario, and a member of the Advisory Board to the International Joint Commission on Pollution of Boundary Waters. In the field of water supply and sanitation, he has been honored with the Fuller Award, Kenneth Allen Award and the Goodell Prize. He holds honorary memberships in the Canadian Institute of Sanitary Inspectors and the AWWA.

He is a member of the Association of Professional Engineers of Ontario. Dr. Berry is married and lives in Toronto. Among his interests are leather tooling, painting china, and gardening.

NEW! FORD

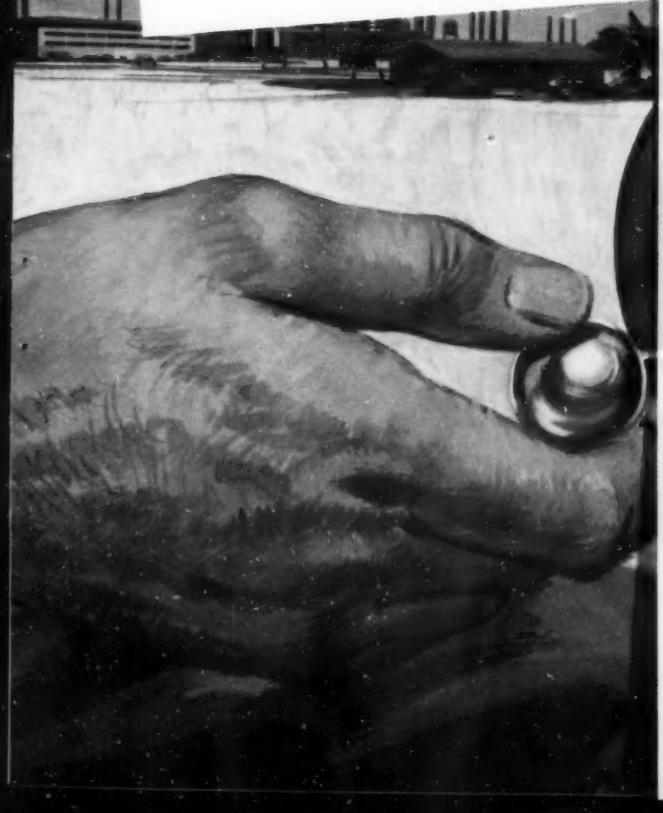
SELECT-O-SPEE

10 SPEEDS FORWARD; 2 REVER

Now, with Ford industrial tractors, you can
to *any* speed under full load and on-the-go! A
touch on the Select-O-Speed lever is all you
to select instantly the right gear to meet char
operating conditions. There's no clutching req
to start, stop, change gears, or to engage o
engage PTO. There's no conventional gear
You merely move the selector for the desired
Hydraulic power does the work of shifting.

New Ford Select-O-Speed will save you tim
you fuel, save you effort. And because y
instantly shift up or down according to vary
conditions—on-the-go and without loss of
or momentum—you'll handle bigger jobs i
tractor power range. Select-O-Speed trans
is available for all series of Ford tractors

AND ONLY FORD HA



NOW!

Shift to any speed

on the GO!

NEW! FORD SELECT-O-SPEED

10 SPEEDS FORWARD; 2 REVERSE

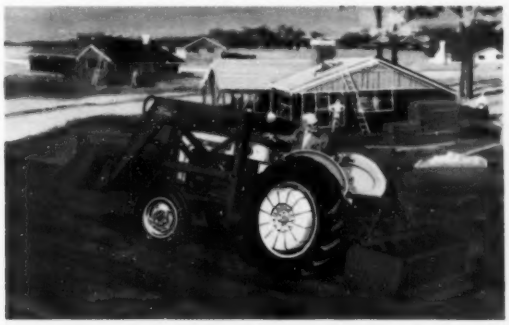
Now, with Ford industrial tractors, you can shift to *any* speed under full load and on-the-go! A light touch on the Select-O-Speed lever is all you need to select instantly the right gear to meet changing operating conditions. There's no clutching required to start, stop, change gears, or to engage or disengage PTO. There's no conventional gear shift. You merely move the selector for the desired speed. Hydraulic power does the work of shifting.

New Ford Select-O-Speed will save you time, save you fuel, save you effort. And because you can instantly shift up or down according to varying job conditions—on-the-go and without loss of power or momentum—you'll handle bigger jobs in every tractor power range. Select-O-Speed transmission is available for all series of Ford tractors . . .

AND ONLY FORD HAS IT!

Greatest Industrial Tractor Advance Since Hydraulics!

LOADING AND BACKFILLING—A touch moves the selector lever to pre-selected stops for easy back-and-forth shifting. You eliminate *five* clutch and gear shift movements every time you move from pile to truck to pile. Down-shift on-the-go as you buck into the pile. Break out heaped payloads every time!



GRADING AND LEVELING—Down-shift in a wink without loss of forward motion when you hit tough spots. As the load eases, shift up again for more speed, more fuel economy. Pull high spots into low ones with quick shuttle-type passes. Use Ford's low, low speeds for more "push" when needed, and for smooth, uniform finish work.

SNOW REMOVAL—With Select-O-Speed you have easy shifting to powerful low gears for big drifts, and to higher, fuel-saving gears when the going is easy. Extra safety is at your finger tips, too, with Select-O-Speed brake assist for stopping on ice.

Design, materials and/or specifications are subject to change without notice and without liability therefor.

SELECT-O-SPEED DETAILS, BACK PAGE ☛

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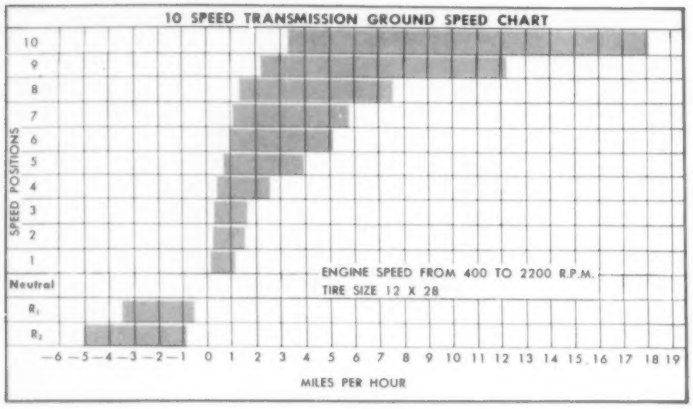
MATCH SPEED AND POWER INSTANTLY FOR PEAK EFFICIENCY



Select-O-Speed lets you instantly choose the exact combination of ground speed and tractor power for top efficiency and fuel economy—not just for the job, but for minute-to-minute variations in operating conditions. Generous overlapping of the 10 forward and 2 reverse speeds at different engine speeds makes it possible to get the desired ground speed in several different gears.

EXTRA SLOW SPEEDS—Creep along as slow as .6 mile per hour at 1200 rpm. A finger touch calls forth extra power for tough spots. And you'll give precision work the look of a hand finish!

UP TO 18 MPH—Fast travel for light towing jobs, highway transport, etc. Select-O-Speed provides extra safety at fast road speeds. You down-shift on-the-go without clutching.

SEE *SELECT-O-SPEED* FOR YOURSELF . . . AND LOOK FOR THESE FEATURES

QUICK-CHANGE LEVER—Selector lever can be changed to left or right side in less than a minute—an added convenience for loader work.

ADJUSTABLE STOPS—Pre-select any of five gears and set stops for the ones desired in shuttle operations. Stops are easily bypassed for other speeds.

INCHING CONTROL—Foot pedal operates feathering valve which lets you inch forward or backward for attaching equipment, doing precision work, or starting heavy tow-loads smoothly. It also interrupts power for emergency stops.

NO "RUNAWAYS"—Rear wheels lock when selector is in "Park" position or when engine is off. You can safely leave the tractor, even on a slope.

TRANSPORT DISCONNECT—Prepared in less than a minute to be towed from job to job at regular truck speeds.

INDEPENDENT PTO—Separate power take-off handle gives easy control of mowers, rotary cutters, etc. PTO is completely independent of gear ratio change and forward movement of tractor and can be gradually engaged.

SELECT-O-SPEED RANGE, MPH			
	Engine RPM		
Gear	1200	1750	2200
10	9.8	14.3	18.0
9	6.7	9.7	12.1
8	4.1	6.0	7.5
7	3.2	4.6	5.8
6	2.8	4.0	5.1
5	2.1	3.1	3.9
4	1.3	2.0	2.5
3	1.0	1.4	1.7
2	.9	1.3	1.6
1	.6	.9	1.2
Neutral	—	—	—
R1	1.9	2.8	3.5
R2	2.8	4.1	5.1
Park	—	—	—

Handle Bigger Jobs in Every Tractor Power Range . . . And at Less Cost!

EXTRA DRAWBAR PULL—You can *double* your pull power merely by changing from 6th to 4th gear. Moving from 10th to 4th increases your power *8 times!* Start extra-heavy loads in a low gear; shift up as your tractor gains momentum. Shift down on-the-go through tough spots; up again when the work eases.

MATCH TO LIGHT LOADS, TOO—Save on fuel, on tractor wear by selecting higher work gears and throttling engine back to a lower rpm. Just look at the overlapping range of speeds in the table and graph above.

FAST, SAFE HIGHWAY HAULING—Start smoothly with your inching control . . . down-shift on-the-go for extra power as you climb the hills, and for brake assist as you come down. Bigger, faster, safer hauling—and all the while it "babies" your tractor!

What is SELECT-O-SPEED?

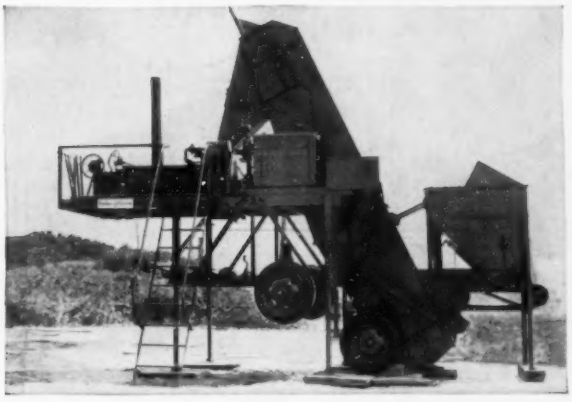
What makes Ford Select-O-Speed unique and boldly different from any transmission ever seen in industrial tractors is the way its four-stage planetary system is controlled—by hydraulics. Select-O-Speed offers manual gear or speed selection, "solid drive" and the other advantages of a gear type transmission, and also the time- and effort-saving advantages of hydraulic power shifting of that transmission.

Select-O-Speed is the world's most advanced tractor transmission . . . stronger because there is three times as much gear tooth contact as in conventional transmissions . . . silent because helically cut gears are always in mesh, can't clash . . . efficient because there is no slipping, no appreciable power loss . . . simple to operate, one lever changes speeds . . . economical, saves time, fuel, and effort.

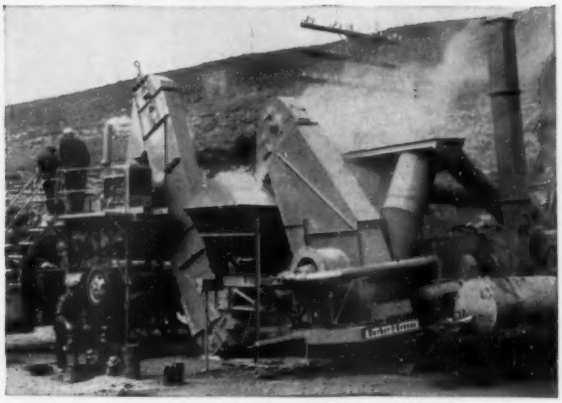
Seeing is believing. *Trying* is even better. Visit or phone your Ford Tractor and Equipment Dealer right now to arrange a demonstration of Select-O-Speed on the Ford tractor of your choice, or write to Ford Industrial Sales Department, 2500 East Maple Road, Birmingham, Michigan. You'll agree the new Ford Select-O-Speed transmission is the greatest tractor advance since hydraulics!

C-7282 TRACTOR AND IMPLEMENT DIVISION, FORD MOTOR COMPANY, BIRMINGHAM, MICHIGAN PRINTED IN U.S.A.

Start with an asphalt plant that can grow with your business



Begin with a mixer, elevator and hopper, and you're set to produce stabilized and cold bituminous mixes at capacities of more than 50 t.p.h. For a low initial investment, the Barber-Greene 840-B gives you big plant features and flexibility.



Later add a dryer to produce hot mixes (to 45 t.p.h.) suitable for nearly every type of paving job. With an aggregate feeder to control cold feed gradation, the complete range of hot mixes can be produced—except specs requiring screening after drying.

For high type mixes, expand operations with a gradation unit to produce mixes (to 45 t.p.h.) to meet any specification. A complete line of dust collectors, cold feeders, mineral feeders is available to meet all of your requirements.

Get big plant features with the low cost Model 840-B. A new, longer twin shaft pugmill, hydraulically operated pugmill discharge hopper, interlocked proportioning, speedy setup, unexcelled portability—all provide more production and profit.

56-5A

Now . . . check into this big money maker. Write for literature

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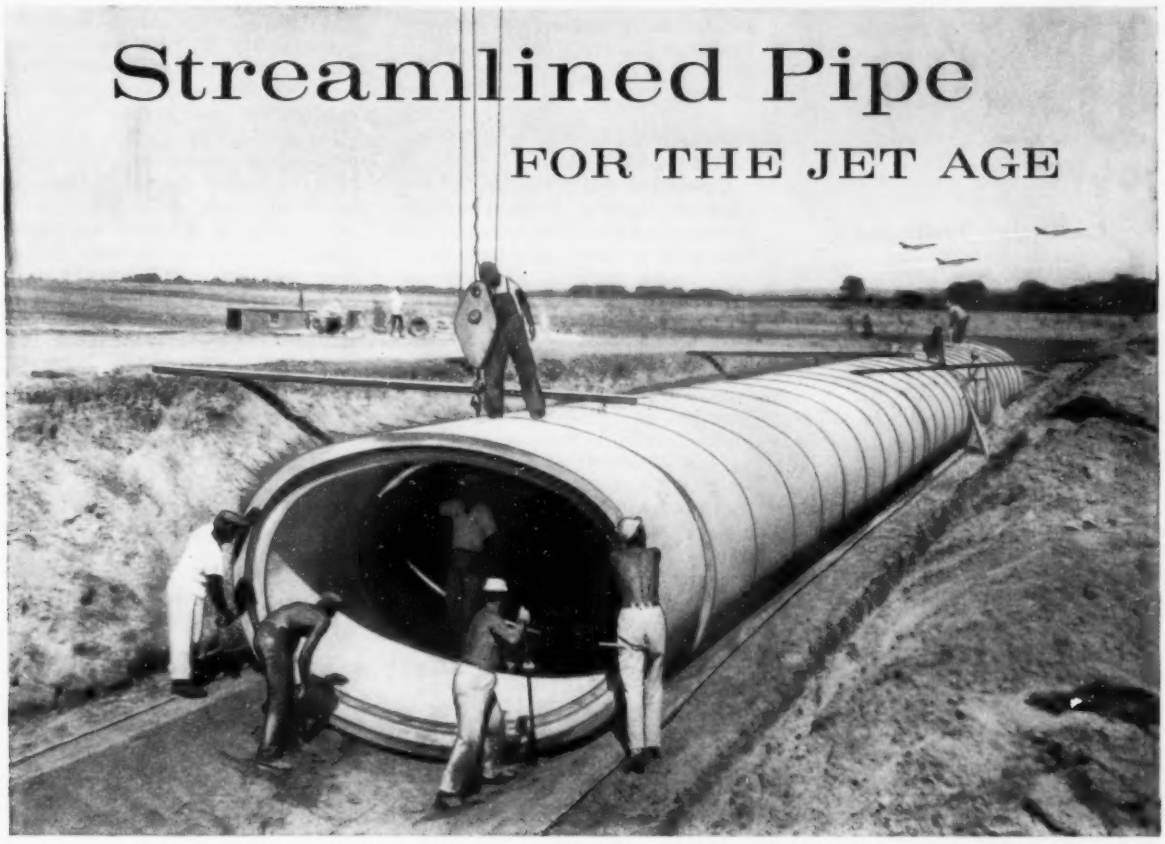
CEMENT-SOIL STABILIZATION

HRB Bulletin 198 covers six papers on cement-soil stabilization that demonstrate the progress being brought about through a number of separate although closely related researches. The first five papers present data on the following: 1) the effectiveness of flyash as an additive and as an replacement for cement in soil-cement; 2) an appraisal of the performance of soil-cement base courses on military airfields; 3) and 4) short-cut methods for determining the cement requirements for sandy and clayey soils, respectively; and 5) the effect of sulfates on the performance of soil-cement. The sixth paper presents a hypothesis that attempts to explain the differences in the nature of the cementing process in granular and in fine-grained (clayey) soil. Copies of the bulletin are $1.40 each and are available from Highway Research Board, 2101 Constitution, Washington, D. C.

URBAN RESEARCH IN HIGHWAY PLANNING

Bulletin 190 contains five papers presented at the 37th Annual Meeting of the Highway Research Board on urban research in highway planning. The first paper, by Paul C. Witt, describes the "Planning and Research Implications of the Washington Transportation Study." In the second Harvey S. Perloff tells how "Regional Research and Highway Planning," is providing a growing pool of knowledge and analytical techniques which have potential value for highway planning. In the third, Leonard J. Duhl discusses the relation between the "Physical Environment and Mental Health." In "Urban Arterial Developments which Benefit the Community," Earle Andrews sets forth the principles adopted by the New York State Council of Parks. In the final paper, Louis B. Wetmore outlines a "Visual Approach to Highway Planning and Design" in terms of pleasure and satisfaction, safety and convenience, and economic values. Copies of this

Streamlined Pipe
FOR THE JET AGE



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Dodson's Digest

County Fair Preliminary

I was driving back to the city from an out-of-town meeting the other day when I came across Chuck Collins, a county highway commissioner, and three of his men standing alongside a truck. They were lighting up big, black cigars.

"Hey, Dod, c'mon over here. We're celebrating," Chuck boomed out in that thunderous voice of his as I pulled over and stopped. He *always* talked like he was nominating somebody for President.

"Celebrating what?" I cried back.

"We laid our last load of Calcium Chloride today," Chuck roared, "covered all our unpaved roads and shoulders."

"You're lucky to get finished so early, Chuck," I said, walking over. "You'll have less maintenance worries the rest of the year."

"And no summer dust problems either," Chuck volleyed back.

"Plus less erosion and fewer skids on loose gravel," I added.

"I've got to hand it to Calcium Chloride," Chuck yelled. "It sure does lay the dust and keep our roads in shape . . . shoulders, too."

My ears were starting to ring—and something snapped. For once, I was going to outshout Chuck Collins.

"Not only that," I bellowed, "but Calcium Chloride reduces break-up in the spring, stops gravel loss, gives excellent moisture control, eliminates pavement drop-offs by keeping shoulders firm and tight against the pavement, and makes——"

"And makes highway commissioners happy," Chuck grinned. "You know, Dod, with that voice of yours, you ought to be in the county fair."

"How's that, Chuck?"

He pointed to a hill behind me. A dozen hogs were heading right for us!

—L. D. Dodson

P.S.—For helpful booklets telling how to solve your road problems, send for "The WHY of Wyandotte Calcium Chloride for Roads" and "How To Stop Bothersome Dust." Just drop me a line. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.*

Wyandotte CHEMICALS

WYANDOTTE CHEMICALS

MICHIGAN ALKALI DIVISION

HEADQUARTERS FOR CALCIUM CHLORIDE

bulletin are available from Highway Research Board, 2101 Constitution Avenue, Washington, D. C. at 80¢ per copy.

APARTMENTS AND DORMITORIES

Covered in this 238-page book are superior examples of recent multiple dwelling architecture, arranged in four groups: community-scale projects, small projects, and campus dormitories and apartments. Many noted architects are represented here, including Frank Lloyd Wright, Mies van der Rohe, Edward Stone, Marcel Breuer and Richard Neutra. Excellent photographs, sketches and plans do much to make each project more meaningful; in all, there are over 450 illustrations. In addition to the 53 projects, the first section, building multiple dwellings, includes discussions of housing patterns, housing expenditures, social problems of apartment design, cutting construction costs and other pertinent material. Copies of this book are $8.95 each and are available from F. W. Dodge Corp., 119 West 40th St., New York 18, N. Y.

HIGHLIGHTS OF AIR POLLUTION CONFERENCE

The National Conference on Air Pollution, sponsored by the Public Health Service, held in Washington last November, has been summarized in an attractive, illustrated 46-page bulletin. While the complete text of all formal presentations has been published separately in the Proceedings of the Conference, "Highlights" gives a thorough but fairly brief review of all pertinent discussions and recommendations and makes good reading for those who are not interested in digging out the details. The bulletin is available as Public Health Service Publication No. 648, from the U. S. Government Printing Office, Washington 25, D. C., at a price of 35 cents.

ARMOUR RESEARCH FOUNDATION ANNUAL REPORT

The Armour Research Foundation of the Illinois Institute of Technology has summarized its past year's activities in a readable and well illustrated 56-page bulletin. The 780 projects of its nine research departments represented a record expenditure of $14.6 million for the 1957-58 fiscal year. Among those of interest to the public works field were: A new type highway reinforcing lattice fabricated from rolled and intermittently slit steel sheet; the feasibility of using tunnels as civilian shelters under nuclear attack; the effect of ozone on animal susceptibility to respiratory infections; various means of white water treatment in paper manufacturing; electrostatic precipitation for sampling and size classification of aerosols; substitute materials for bronze in water-motor casings; welding of reinforcing bars; evaluation of clays as lightweight concrete aggregate; phosphate slag as concrete aggregate; and increased resistance of *E. coli* to gamma radiation. Copies are obtainable from the Armour Research Foundation, 10 W. 35th St., Chicago 16, Illinois.

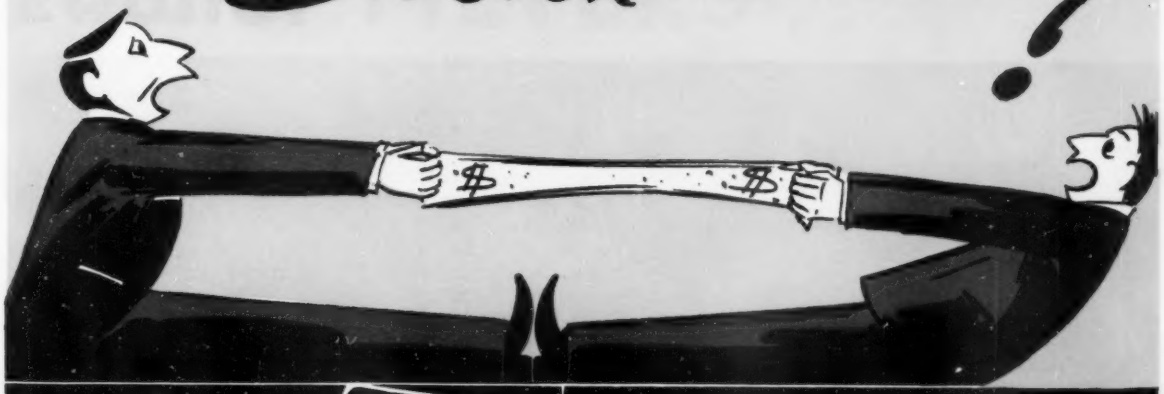
HIGHWAY NEEDS STUDIES 1958

These seven papers on highway needs studies were presented at the 37th Annual Meeting of the Highway Research Board: "What Should Highway Needs Study Reports Contain?" by Homer A. Humphrey and James A. Foster; "A Highway Taxation Cost-Benefit Analysis" by Bertram H. Lindman; "Indiana's Highway Needs Study" by D. O. Covault; "Analysis of County Road Management Functions" by John B. Benson, Jr.; "Traffic Growth Patterns on Rural Highways" by Theodore F. Morf and Frank V. Houska; "Vehicle Delay at Signalized Intersections As a Factor in Determining Urban Priorities" by R. N. Grunow; and "Tennessee's Programming Study: First Year's Experience and Techniques for Updating" by Philip M. Donnell. Published as Bulletin 194, copies are $1.20 each from Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

LIME AND LIME-FLYASH SOIL STABILIZATION

These five papers on lime and lime-flyash soil stabilization were given at the 37th Annual Meeting of the Highway Research Board: "Durability of Soil - Lime - Flyash Mixes Compacted Above Standard Proctor Density" by J. M. Hoover, R. L. Handy and D. T. Davidson. "Structural Properties of Lime-Flyash - Aggregate Compositions," by Richard H. Miller and William J. McNichol. "Reactivity of Four Types of Flyash with Lime" by D. T. Davidson, J. B. Sheeler and N. G. Delbridge, Jr. "Lime-Stabilized Test Sections on Route 51, Perry County, Missouri" by W. G. Jones. "Stabilization of Expansive Clay with Hydrated Lime and With Portland Cement" by Chester W. Jones. Bulletin 193 is available from the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C., at $1 per copy.

TRYING TO *Stretch* YOUR SIGN BUDGET?



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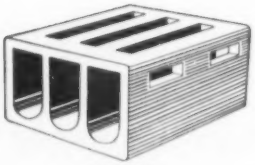
TRICKLING FILTER



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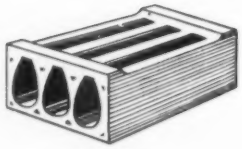

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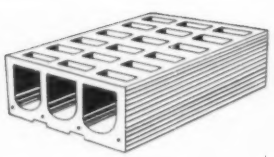
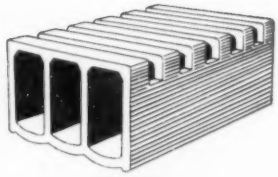
327 Fifth Ave.
Pittsburgh 22, Pa.



DICKEY

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.

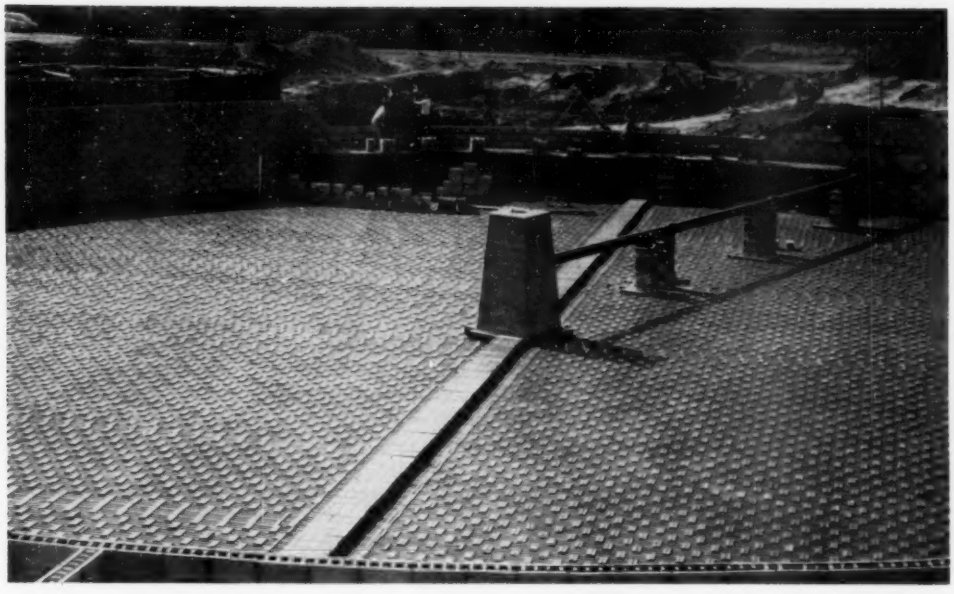


TRANSLOT

Texas Vitrified Pipe Co.
Mineral Wells, Texas

GOOD FILTERS . . .

Trickling Filters with TFFI Vitrified Clay Block Underdrains are good filters!



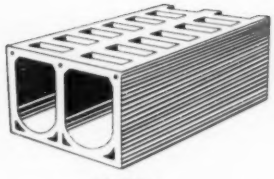
Ozark, Alabama, standard rate filters with TFFI specification underdrain blocks. Capacity 1 MGD flow.

ENGINEERS are invited to ask any member of the Institute for a copy of approved Specifications A S T M C-159-55 for use in designing Trickling Filters.

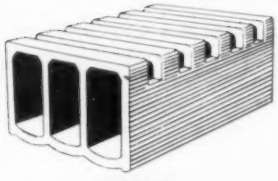
Trickling Filters afford such major advantages as low initial, operating and maintenance costs; efficiency even under overloads, and a minimum of operating personnel.

Vitrified Clay floor blocks of TFFI Specifications for the underdrains are a big factor in the success of Trickling Filters. These blocks combine many points of permanent excellence. They defy the destructive forces of acids, alkalis and bacterial action; are guaranteed for 50 years; are made in modern plants under rigid quality controls impossible for most substitute materials; have maximum crushing strength, give higher velocity in flow, and offer light weight for ease of handling and laying.

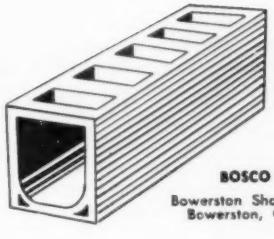
FLOOR INSTITUTE **TFFI**



ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



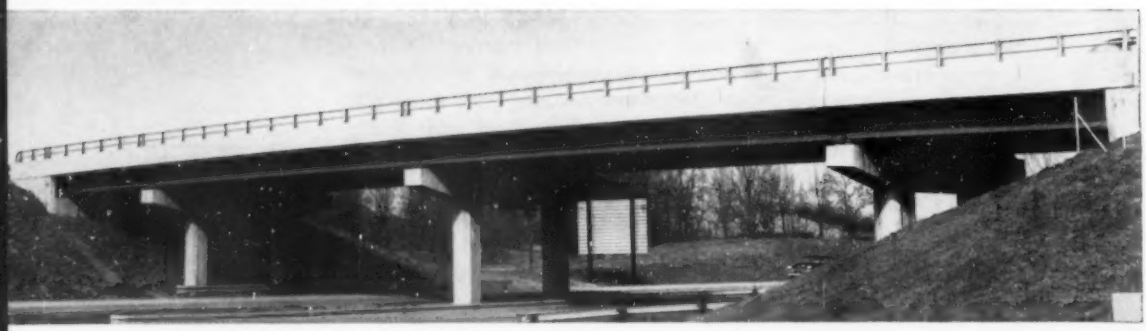
TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

KEEP OUR ROADS ON THE GO

American Bridge helps you



Structural steel is clearly the best bridge construction material. Manufactured to precise, long-established standards, steel combines both strength and toughness. Structural steel accommodates spans of any length. Its strength is inherent, predictable and permanent. It can be erected quickly throughout the year—can be accurately inspected at any time. Steel structures can be connected by any method, can be altered easily. Structural steel is clearly the best bridge construction material.

USS AmBridge I-Beam-Lok steel bridge flooring combines light weight; roadway rigidity; speedy, easy erection; matchless durability, and low maintenance. There are three types—5" open, 4¼" and 3" concrete-filled, and 2" concrete-filled Tee-Type Sidewalk. Top-side erection eliminates scaffolding and forms. I-Beam-Lok provides an immediate working platform for men and equipment during erection. Over-all economy is the natural by-product of the multiple savings in time, weight, bother and maintenance.

USS AmBridge Sectional Plate is the ideal material for low-cost, rapid construction of large drainage structures. It is available in Pipe, Pipe-Arch and Arch Sections, in a wide range of standard sizes and gauges for various drainage requirements. Complete structures can be transported in one truck load, and the individual plates can be handled and assembled easily without heavy equipment.

USS AmBridge Highway Beam Guard Rail is designed to withstand high impact forces. It possesses all the design features of the modern universal guard rail section adopted by most state highway departments, and offers several exclusive advantages that assure better service. Its quality, strength, ease of installation, controlled flexibility, high visibility, and low maintenance make USS AmBridge Highway Beam Guard Rail the finest traffic safeguard available.

build more road for the money

All American Bridge steel highway products meet the most rigid municipal, state, and federal engineering standards. All can be handled easily, installed quickly. All possess dimensional accuracy assuring precision fit in the field—by bolting, riveting or welding. Steel highway products can be installed the year round. No other construction material is so easy to extend, alter or inspect as steel.

All American Bridge steel highway products are readily available. An inquiry to any of the contracting offices listed below will bring catalogs and other desired information. Or write direct to Pittsburgh.

USS and I-BEAM-LOK are registered trademarks

American Bridge Division of USS United States Steel

General Offices: 525 William Penn Place, Pittsburgh, Pa.

Contracting Offices: Ambridge • Atlanta • Baltimore • Birmingham • Boston • Chicago • Cincinnati Cleveland • Dallas • Denver • Detroit • Elmira • Gary • Harrisburg, Pa. • Houston • Los Angeles Memphis • Minneapolis • New York • Orange, Texas • Philadelphia • Pittsburgh • Portland, Ore. Roanoke • St. Louis • San Francisco • Trenton • United States Steel Export Company, New York

"Our Ford F-800's, pulling 20-ton payloads, give us mighty good service!"

says R. Dillard Teer, Vice President
Nello L. Teer Co., Durham, N. Carolina

"We operate about 115 Ford Trucks ranging in size from ½-ton pickups to Tilt Cab Tandem tractors. We believe in carefully fitting the truck to the job to be done and usually stay within the manufacturer's recommended ratings. We make an exception to this rule with our Ford F-800's, pulling 20-ton loads in aluminum trailer dumps to our quarry and crushing setup at Durham, North Carolina. These units are carrying the maximum legal limit and give us mighty good service!

"We haven't traded any trucks in about 6 years. It just happens that our company has been growing so rapidly that when we buy a new truck, usually an F-800, I put it under one of our trailer dumps. Then I'll take the old truck, lengthen the chassis, and make a grease outfit or a water wagon out of it. I would say out of over a hundred Ford units in the past 7 or 8 years, we have gotten rid of only a dozen altogether—and some of these were wrecked or burned.

"Another reason we use Fords is that this business is rough on trucks, so parts availability is very important. Our experience over the years with Ford as compared to Ford competitors has been definitely in favor of Ford on parts."

NOW! CERTIFIED PROOF!

FORD TRUCKS COST LESS

'59 Ford Pickups beat average mileage of other leading makes by 25.2% in Economy Showdown U.S.A.

Here at last is certified proof of the differences in gas mileage between six-cylinder pickups . . . evidence that you can use in your operation.

It was compiled by America's foremost independent automotive research firm after testing 1959 six-cylinder, ½-ton pickups of the six leading makes. All trucks were bought from dealers—just as you would.

The tests paralleled every kind of driving – high speeds and low, open highways and city traffic, even door-to-door delivery. And in every test, '59 Ford Sixes delivered more miles per gallon than any other make. Here are the actual percentages:

'59 FORD PICKUP SIXES GAVE

42.6% better mileage than make "D"
31.1% better mileage than make "I"
25.2% better mileage than make "C"
22.0% better mileage than make "S"
9.6% better mileage than make "G"

Taken together, Ford got 25.2% more miles per gallon than the average of all other leading pickups!

What's the secret of Ford's economy? First, of all pickup sixes, only the Ford Six has modern Short Stroke design which reduces friction and requires less fuel. Second, to this modern engine, Ford has added a new economy carburetor to meter fuel more precisely in both high- and low-speed ranges.

See your Ford Dealer for the full report of Economy Showdown U.S.A. and get the whole story firsthand.

All tests conducted and results
CERTIFIED
by America's foremost independent automotive research organization*
***NAME AVAILABLE ON REQUEST**
Send inquiry to P.O. Box 2687, Ford Division
Ford Motor Co., Detroit 31, Michigan

Now! During Dividend Days at your Ford Dealer's...Go *FORD*-ward for Savings

Year/1939

Problem:

Carry sewage under an irrigation canal without infiltration.

Solution:

Install Armco Corrugated Metal Pipe. The tight joints stopped infiltration.

Here is the sewer after 20 years' service.

This 36-inch Armco Corrugated Metal Pipe is shown after 20 years of carrying fast-moving corrosive sewage under an irrigation canal in Pueblo, Colorado. There is still no measurable infiltration. Sewer is good for many, many more years of service.

New steels are born at Armco

WRITE FOR CATALOG. For complete details on Armco Sewer Structures write Armco Drainage & Metal Products, Inc., 6479 Curtis Street, Middletown, Ohio.

ARMCO DRAINAGE & METAL PRODUCTS

Subsidiary of ARMCO STEEL CORPORATION

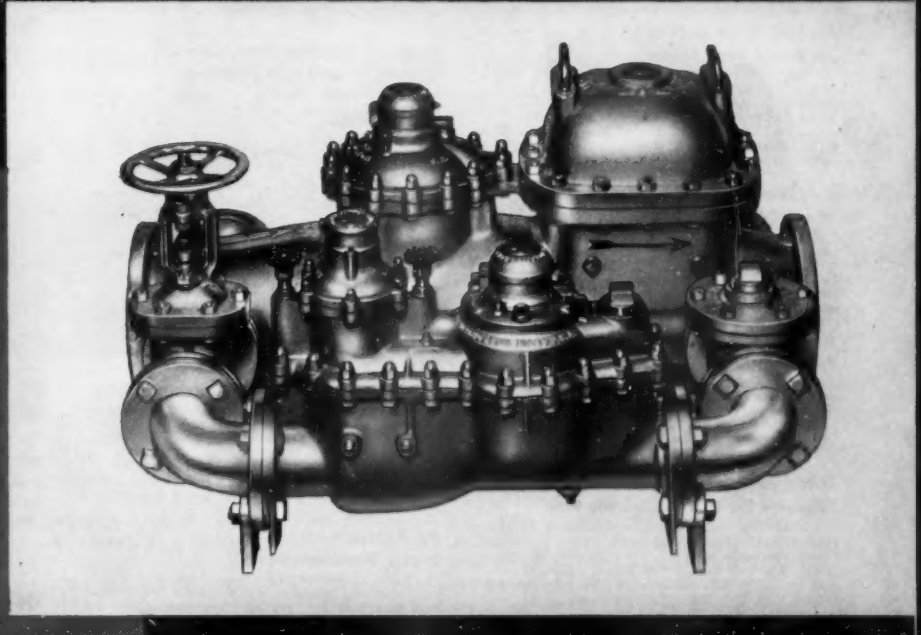
OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

This Counterbalanced Lever Valve is an exclusive, outstanding feature of HERSEY Detector Meters, Compound Meters and Detector Checks. Unequaled for continuous, dependable operation.

HERSEY

HERSEY 1859 1959 100 YEARS OF PROGRESS

DETECTOR (Fire Service) METER



HERSEY
MANUFACTURING COMPANY

(Established 1859)

DEDHAM, MASS.

BRANCH OFFICES

NEW YORK — LOS ANGELES — CHICAGO — PHILADELPHIA
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"You can't buy a better water meter than HERSEY"

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Surface Wash Baffles for Rapid Sand Filters

39. Feco Lightning surface wash baffles save 50 percent of the backwash water, prevent short circuiting, provide even distribution and maintain filter balance. For Catalog No. 5-2 write to Filtration Equipment Corp., P. O. Box 1331, Rochester 3, N. Y., or check the reply card.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Badger Meter Mfg. Co., 4545 W. Brown Deer Rd., Milwaukee 18, Wis. Check the reply card for full details on these accurate meters.

Center-Mounted Rotary Mowers For More Miles of Rugged Mowing

127. Four sizes in 58, 60, 66 and 94-in. cuts are available with the Danco rotary mowers. Check the reply card or write International Harvester Co., P. O. Box 7333, Chicago 80, Ill., for full data on these mowers for International tractors.

Damaged Barricades Can Be Repaired With PM Barricade Kits

163. PM barricade kits provide a flexible replacement system for damaged barricades. Check the reply card or write Pacific Mercury, 14052 Burbank Blvd., Van Nuys, Calif., for details on PM transistor neon or incandescent flasher warning lights.

All-Purpose Loader for Street and Highway Departments

237. Pettibone Speed Swing loader is an all-purpose unit that can be used by cities, counties and states in street and highway maintenance and construction. Check the reply card or write Mr. Mal Hume, vice president, Pettibone Mulliken Corp., 4700 West Division St., Chicago 51, Ill., for 76-page catalog on this unit.

Slag, the All Purpose Construction Aggregate

304. Air-cooled slag for Portland cement concrete, bituminous mixtures and trickling filters; expanded slag for lightweight structural concrete and masonry units; and granulated slag for bases for highways are fully described in literature from National Slag Association, 613 Perpetual Bldg., Washington 4, D. C. Check the reply card for specifications.

Handbook on Texaco Cold Patch

286. How to make, mix, cure, store and place Texaco cold patch are sections of this handbook. Check the reply card or write The Texas Co., Asphalt Sales Div., 135 E. 42nd St., New York 17, N. Y., for details on this patching material that adds years to the life of streets and highways.

For Today's Modern Highways Hot-Dip Galvanized Steel

302. Hot-dip galvanized steel means maintenance-free highways, is easy to install and can be used in practically every part of the highway network. Check the reply card or write American Hot Dip Galvanizers Association, Inc., First National Bank Building, Pittsburgh 22, Pa., for full data.

Valuable Catalog on Municipal Equipment and Sign Supplies

314. Traffic signs of all types, line markers, signals, pumps, police equipment and a hundred other items are included in this 130-page catalog from Sargent-Sowell, Inc., 1172-107th St., P.O. Box 868, Grand Prairie, Texas. Check the reply card.

7 Developments For Municipal and Industrial Sanitation

319. Bulletin 6043 assembles for review the 7 major Dorr-Oliver equipment designs and process developments introduced in the past 3 years. It includes photographs, line and wash drawings and descriptive sketches of each development. Check the reply card or write Dorr-Oliver Incorporated, Stamford, Conn., today.

Belt Conveyors and Bucket Elevators for Handling Bulk Materials

381. Conveyors and elevators for handling all types of bulk material such as sand, gravel, stone and cinders are described in Bulletin MH-57 available from Sesco Engineering & Supply Corp., North Kansas City 16, Mo. Check the reply card for data on belt conveyor calculations, belt tensions, idlers and truss frames.

pH Recorder for Water Departments

388. A pH recorder consisting of a Beckman electrode assembly and amplifier and a Bailey potentiometer recorder is described in Bulletins E12-4, E67-5 and E67-6 from Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio. Check the reply card for charts, tables and drawings that are used in proper selection of units.

Meters-Feeders-Controls for Positive Control of Materials in Motion

412. Catalog B-I-F 6 includes a series of illustrated thumbnail descriptions of applications and equipment for water, sewage and waste treatment plants. Check the reply card or write W. W. Adams, Director of Public Relations, B-I-F Industries, Inc., Providence, R. I., for data on this equipment.

Water and Sewer Mains Cleaned Like New

469. Clogged sewers and water pipes cleaned with custom-built power equipment that removes tuberculation and mineral deposits. For details write Ace Pipe Cleaning Co., Inc., 3513 East 18th St., Kansas City, Mo., or check the reply card.

Prefab Concrete Lift Station

480. The Liftmaster underground sewage pumping station, factory-built of concrete and completely equipped with piping, pumps, automatic controls and wiring, is described in bulletin available from MCG Co., 1771 West Fifth Ave., Columbus 12, Ohio. Check the reply card.

Vertical, Close-Coupled Sewage Pumps

548. Bulletin on vertical, close-coupled "Non-clog" sewage pumps contains suggested specifications and details of design. Check the reply card or write Smith & Loveless, Inc., P. O. Box 8884, Kansas City 15, Mo.

Equipment for Water, Sewage and Industrial Waste Treatment

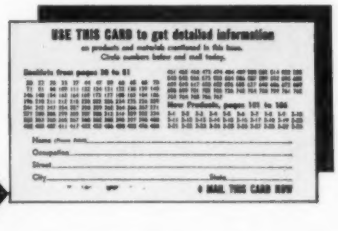
549. Catalog 952 contains sections on water and bar screens, grinders, collectors, settling tanks, scum removers, FLOCTROLS, feeders, conveyors and chains and sprockets. Check the reply card or write Advertising Dept., The Jeffrey Mfg. Co., Columbus 16, Ohio, for drawings, charts and installation photographs of all the equipment.

Allis-Chalmers Motor Graders and Diesel Crawler Tractors

556. Complete data on the Model Forty-Five motor grader and the HD-16 and HD-16 DC and D diesel powered crawler tractors are covered in bulletins from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc.

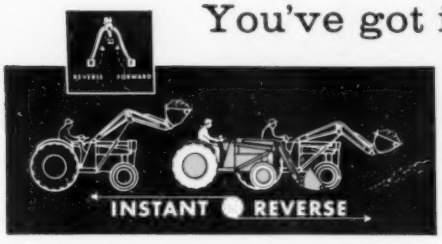
Stabilized Base Mixers for Road Construction

563. Two models of Cedarapids stabilized base mixers are described in 8-page bulletin from Iowa Mfg. Co., Cedar Rapids, Ia. Units will mix 300 to 600 tph of aggregate with a specified water additive. Check the reply card.



M-F... has the only New Approach to Utility Rigs

INSTANT ● REVERSING



You've got it Coming... or Going on the New WORK BULL 204 with Torque Converter

Massey-Ferguson again shows its leadership in the industrial field with the most important development ever made on industrial utility tractors. This all-new, field-proven Work Bull 204 changes directions instantly, but smoothly, at the touch of your toe – and has a torque converter to maintain correct power-to-load ratio. An efficient 3-point pedal control lets you select forward, reverse, or just engine acceleration. Your hands are free to control the tractor or Davis Loader attachment.

The Work Bull 204 has a high-torque, 40-hp engine with four equal speeds in either direction to provide a wide work range as well as a favorable road speed. It has full-time power steering, individual left and right brakes, and a hand throttle to pre-set engine rpm for operating attachments. The exclusive Ferguson 3-point hitch provides hydraulic draft control for rear-end attachments. Your choice of new model Davis Loaders, Backhoes, Scarifier-Scrapers, or other power-matched M-F attachments gives you the best all-around rig you could ever own. ***Write for the name of nearest dealer and see him soon.***

Work Bull 1001
Work Bull 303 with 500 Loader and Davis Backhoe
Work Bull 202 with Davis Loader and Backhoe
Work Bull Fork Lift

MASSEY-FERGUSON INDUSTRIAL DIVISION
1009 SOUTH WEST STREET • WICHITA 13N, KANSAS

To order these helpful booklets check the reply card opposite page 36.

NEW LISTINGS (Cont.)

Machines for Public Service

561. Last cost, or the final over-all cost of purchasing and maintaining a machine, is of the utmost importance in the purchase of equipment for public service and this theme is expanded in bulletin available from Advertising Div., Foreign Trade Group, Caterpillar Tractor Co., Peoria, Ill. Check the reply card.

Gradall Will Do a Variety of Jobs

564. The Model G-1000 Gradall has a lifting capacity of 7 tons, turns 360° and will dig 18' 3". Check the reply card or write Warner & Swasey Co., Construction Equipment Div., 5701 Carnegie Ave., Cleveland 3, Ohio, for complete details.

Use The Reply Card

Bitumastic For Lasting Protection Against Corrosion

570. Bitumastic protective coatings prevent corrosion of metal and deterioration of concrete and masonry and are fully covered in catalog from Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa.

Plastic Traffic Markings For Durable Traffic Control

576. Nefolabs include rectangles, strips, arrows, letters and numerals in a variety of shapes, sizes and colors and are adaptable to all types of traffic control uses. Check the reply card or write J. W. Neff Laboratories, Inc., Stockertown, Penna.

Park Benches and Picnic Tables

593. Complete, fully illustrated catalog on park benches and picnic tables is available from American Playground Device Co., Anderson, Ind. Check the reply card.

Weinman Horizontal Non-Clog Centrifugal Pumps

579. Non-clog pumps for sewage and sludge in municipal plants are covered in literature from the Weinman Pump Mfg. Co., 290 Spruce St., Columbus 8, O. Specifications and dimensions are included.

Standardized Motor Control Centers

581. The Unitrol is designed to meet your specific control requirements by providing full open phase protection with 3-coil overload relays and other features. Check the reply card or write Cutler-Hammer, Inc., Milwaukee 1, Wisc.

Data on Standard Storage Tanks

594. Graver's informative bulletin on the many uses of standard cone-roof tanks presents the many applications and includes tables of sizes, capacities, specifications and accessories. Check the reply card or write Graver Tank & Mfg. Co., Division Union Tank Car Co., East Chicago, Ind.

Literature on Illuminated Pedestrian Push Button

598. Complete details on the Presslite pedestrian push button are covered in literature from The Marbelite Co., Inc., 179 North 10th St., Brooklyn 11, N. Y. Check the reply card.

Smith-Tapping Machines for Tapping Operations 2" to 42"

600. Tapping machines for making connections to fluid and gas service lines under pressure are covered in catalog from The A. P. Smith Mfg. Co., East Orange, N. J.

Sewer Cleaning Service By National Power Rodding

601. N.P.R.C. has mobile-mounted equipment and trained personnel ready at all times for routine sewer cleaning jobs or specialized service. Write National Power Rodding Corp., 1000 South Western Ave., Chicago 12, Ill., or check the reply card for services available from this company.

Ford Tractor Can Be Shifted "On-the-Go"

602. New Ford tractor transmission has 10 forward, and two reverse speeds and can be shifted without the use of a clutch pedal. For complete details write Tractor and Implement Div., Ford Motor Co., Birmingham, Mich., or check the reply card.

Manual on Homestead Lubricated Plug Valves

608. This reference book covers all types of lubricated plug valves and gives specifications, drawings and operation data. Check the reply card or write Homestead Valve Mfg. Co., Coraopolis, Pa., for this manual.

Caterpillar Engines Supply a Wide Range of Horsepower

616. Caterpillar engines, either diesel or electric, can be supplied in a wide range of standard packages or special assemblies to fit your needs. Write the Engine Div., Caterpillar Tractor Co., Peoria, Ill., or check the reply card for literature on models and specifications.

Aluminum Beam Guard Rail Ends Maintenance

619. Specifications, drawings and installation of Alcoa Aluminum Company of America, Dept. 1912-E, Alcoa Bldg., Pittsburgh 19, Pa. Check the reply card.

Highway Mowing with the Mott Hammer-Knife

625. One mower for all highway mowing jobs whether rough or smooth, grass or weeds, wet or dry. Check the reply card or write Mott Corp., 4009 Eberly Ave., Brookfield, Ill., for literature.

Manual of Rubber Seat Butterfly Valves

638. Low and high pressure valves, combination valve and expansion joint, insert valving and extra end valving are some of the valves and uses covered in manual from Henry Pratt Co., 2222 S. Halsted St., Chicago 8, Ill.

BAUGHMAN SAND and CINDER SPREADER

SAFETY CHAMPION FOR STREETS AND HIGHWAYS
choice of 4 drives

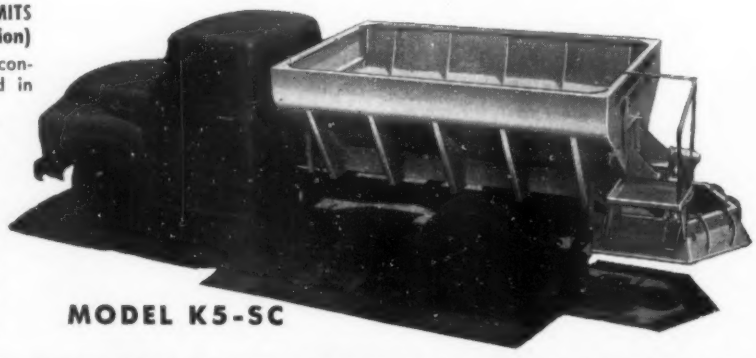
PTO with { Mechanical Operation / Hydraulic Operation } | Auxiliary Engine with { Mechanical Operation / Hydraulic Operation }

CAB CONTROLLED VACUUM CLUTCH PERMITS SPOT SPREADING (on mechanical operation)

Completely sealed, vacuum operation, controlled from cab. Start or stop spread in motion, as at intersections, safety zones. On hydraulic operation models, spot spreading is controlled by by-pass valve.

TWO-SPEED "QUICK CHANGE" MECHANISM

Simple sprocket and chain drive: low for chemical spreading, high for large-volume spreading. No need for expensive automotive transmission. On hydraulic opetation models, spreading volume is valve controlled.



MODEL K5-SC

Better service through better engineering

WRITE FOR NEW ICE CONTROL CATALOG!

Service and parts from 200 service branches

BAUGHMAN

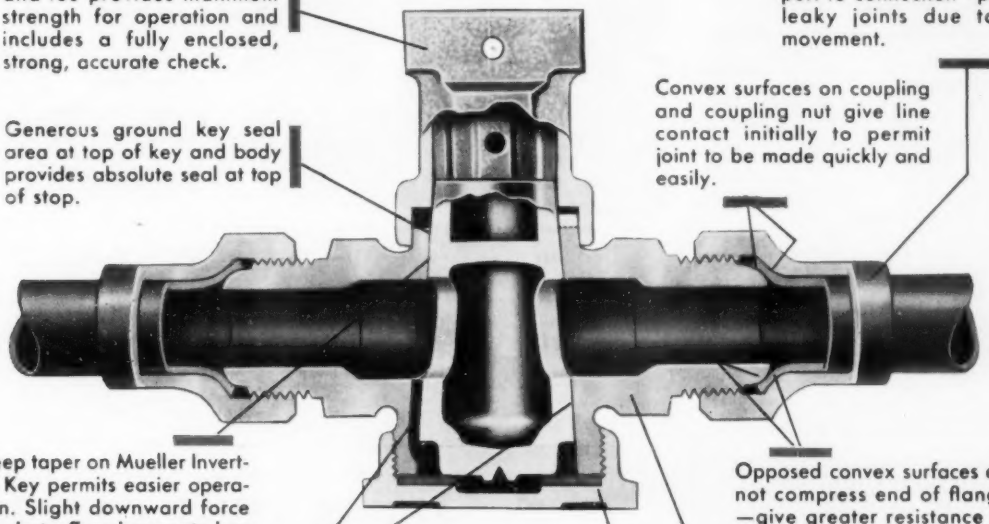
BAUGHMAN MANUFACTURING COMPANY

219 SHIPMAN ROAD — JERSEYVILLE, ILL.

MUELLER®

inverted key curb stops

easy turning . . . pressure tight . . . maintenance free . . .



Large bronze combined cap and tee provides maximum strength for operation and includes a fully enclosed, strong, accurate check.

Generous ground key seal area at top of key and body provides absolute seal at top of stop.

Steep taper on Mueller Inverted Key permits easier operation. Slight downward force on shut-off rod unseats key for easier turning.

A small bypass allows inlet water pressure to exert force on bottom of key to provide an additional seating force. The higher the pressure, the greater the seating force.

Heavy inverted bronze key is accurately machined and individually ground and lapped into the body for absolute water-tight closures.

Extra long skirt on copper coupling nut gives added support to connection—prevents leaky joints due to pipe movement.

Convex surfaces on coupling and coupling nut give line contact initially to permit joint to be made quickly and easily.

Opposed convex surfaces do not compress end of flange —give greater resistance to pipe pulling out.

Heavy water works bronze stop body gives maximum strength and resists corrosion.

Bronze base cap and resilient leather seal hold key in place. Seal acts as bearing surface when turning key and provides seal at bottom of stop.

H-15200
Inverted Key Curb Stop
Combined Cap and Tee
with Check
Copper Coupling
Connection
Sizes: ½" through 2"

These features are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry. Mueller Inverted Key Curb Stops are available in a complete range of sizes and styles.

For full details contact your Mueller Representative or write direct to:

MUELLER CO. DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

To order these helpful booklets check the reply card opposite page 36.

NEW LISTINGS (Cont.)

Odor Control Treatments for Sewage Plants and Storm Sewers

646. Poly-cide odor control treatments have been successfully used by municipalities in eliminating obnoxious odors from sewage plants, storm sewers, garbage and rubbish trucks, refuse cans and public rest rooms. Write Brooks Chemicals, Inc., 3304 E. 87th St., Cleveland 27, Ohio, or check the reply card for literature.

Engines for the Public Works Field

653. General descriptions, detail dimensions, accessory details and drawings of Continental Red Seal industrial engines are covered in bulletin from Continental Motors Corp., Muskegon, Mich. Check the reply card.

Use The Reply Card

Roots-Connersville Rotary Gas Meters

664. Bulletin M-258 covers complete data on R-C rotary positive displacement meters. Check the reply card or write Roots-Connersville Blower Div. of Dresser Industries, Inc., 559 Poplar Ave., Connersville, Ind., for your copy.

Sparling Broad Gauge Compound Meters

666. All flows registered on one totalizer is the feature on the Sparling meter. Write Sparling Meter Co., 225 N. Temple City Blvd., El Monte, Calif., or check the reply card for Bulletin No. CF 333-1 that describes this unit.

Are You Having Compaction Problems?

676. Small, self-propelled, one-man operated heavy-duty vibratory tampers enable you to compact any material to specifications. Literature available from Vibro-Plus Products, Inc., Stanhope, N. J., or by checking the reply card.

Load-Packer With the Big Six Performance by Gar Wood

703. The Load-Packer 600 includes a telescopic hoist that does not require a hoist and sub-frame; simplified controls; and a large 1½ cu. yd. hopper. Catalog from Customer Service Dept., Gar Wood Industries, Inc., Wayne, Mich., or by checking the reply card.

Radio Traffic Control Systems

704. Flexible and reliable method of centrally coordinating and synchronizing traffic lights through utilization of the most recent advances in electronics is covered in literature from Motorola Inc., Communications and Industrial Electronics Div., 4501 West Augusta Blvd., Chicago 51, Ill. Check the reply card.

Safety Devices for Road Hazards and Accidents

705. Portable warning devices that have 2-way top-flashers plus 2-way steady flashlights, 4-way circuit switch and collapsible legs are described in bulletin from Tedcar Products Co., Box 1209, Union, N. J. Check the reply card.

Self-Priming, Portable, Pumping Units

706. Unit weighs 143 lbs., will pump 20,000 gph and can be carried by 2 men or wheeled by 1. Check the reply card or write Hale Fire Pump Co., Conshohocken, Pa., for rating charts and specifications.

Manual on Tunneling Practices

707. Engineering data, tables, graphs and typical installations of tunnel building and Armco liner plates are covered in manual from Armco Drainage & Metal Products, Inc., Product Information Service, Middletown, Ohio.

All-Steel Safety Barricade

709. Highway departments and contractors can use this Guard-Gate in construction and maintenance. Write West Side Iron Works, Inc., 327 Front Ave., N.W., Grand Rapids 4, Mich., or check the reply card for literature on this collapsible barricade.

WATER WORKS

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Plastic Wash Troughs For Water Treatment

45. Leopold fiberglass-reinforced plastic wash troughs for water treatment are described in literature from F. B. Leopold Co., Zelienople, Pa. Check the reply card for data on these units that will last for years without any painting or other maintenance.

Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American Water meters described in Bulletin No. 56 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Check the reply card.

Simplified Rate-of-Flow Controller for Filters

106. The "Modulair" is a self-contained unit which may be inserted in a rapid sand filter effluent line for rate-of-flow control. Its application and compact, simplified construction are described and illustrated in color in Bulletin 951. Write Simplex Valve and Meter Co., Lancaster, Pa., or check the reply card.

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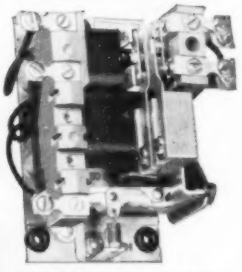

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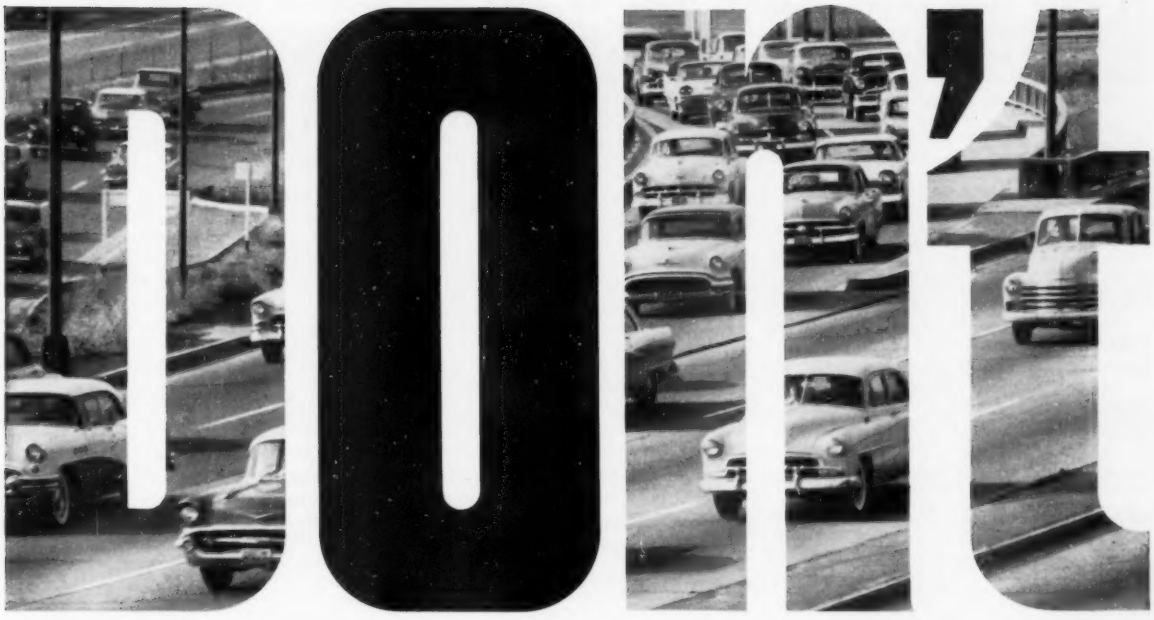

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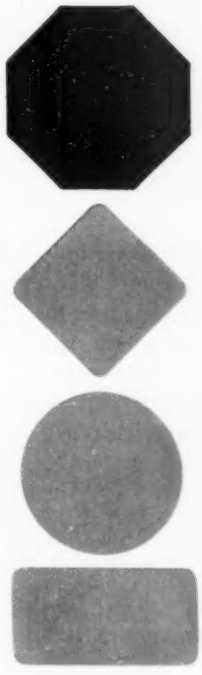

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Clinton, Mass.
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Easily Cleaned Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp, Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model RJ-Pressure or HCV-Vacuum Type diatomite slurry feed filter for swimming pools or Municipal Water Works from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Helpful Reference Catalog on Waterworks Gate Valves

146. All necessary details on Double Disc Parallel Seat Gate Valves for waterworks use are provided in the attractive 36-page bulletin issued by Ludlow Valve Mfg. Co., Inc., Troy, N. Y. Conveniently arranged design data shows all dimensions for 2" to 60" valves. Gearing, floor stands, operating devices are covered too. Get Bulletin 54W by checking the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Lay Water Mains Faster With "Fluid-Tite" Couplings

184. Get permanent water-tight joints automatically with K & M "Fluid-Tite" couplings for K & M asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keasbey & Mattison Co., Ambler, Penna

Specifications on Heavy-Duty Air-Cooled Engines

191. Models, dimensions and power curves of Wisconsin air-cooled engines are covered in catalog from Wisconsin Motor Corp., Milwaukee 46, Wisc. Check the reply card for full details.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestessed concrete for storage tanks. Check the reply card or write The Preload Co., Inc., 21 East 37th St., New York 16, N. Y.

Manual on Filter Bed Agitators

206. General information-specification and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Review of Diatomite Filtration of Water

285. A detailed review of the application of diatomite in the general field of water filtration, including uses in municipal supply and swimming pools is contained in a well-prepared 16-page bulletin. Specific applications to certain water treatment problems are also discussed. Write to the Dicalite Department, 612 So. Flower St., Los Angeles 17, Calif. for Bulletin BW-13 entitled, "Diatomite Filtration of Potable Water," or check the reply card.

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Another sewerage problem . . . 70% of Project's approximate 127,000 feet of pipe had to be installed in floodway area, where water levels would often be 35 feet above invert of pipe. Gaskets would have to meet rigid requirements for strength, long life.

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Dallas, Texas

Solves high water level problem with Press-Seal Rubber Gaskets

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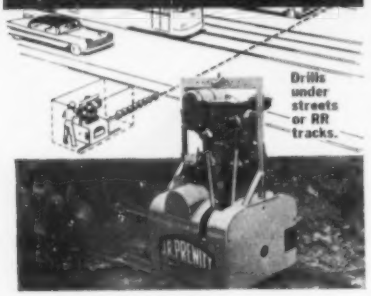

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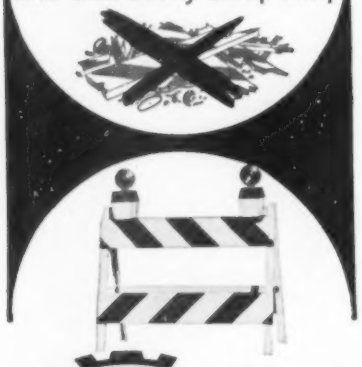

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Manual on Coatings to Stop Rust

235. Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. The larger model is available with air power unit to eliminate manual pushing. Get full details by checking the reply card. Trojan Mfg. Co., 1114 Race Dr., Troy, Ohio.

Waterworks and Municipal Castings

293. Meter boxes and covers, yokes and couplings, service boxes and manhole covers are covered in 24-page catalog. Check the reply card or write H. W. Clark Co., Mattoon, Ill., for full specifications.

Quick Review of Water Meters

316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Get Bulletin W-800 by checking the reply card.

Submersible Pumps for Water Supplies and Booster Systems

328. Selection tables, performance curves, construction details and the many features of Myers submersible pumps are covered in Catalog 140 available from The F. E. Myers & Bro. Co., 249 Orange St., Ashland, Ohio.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-⅝"x¾"-¾" and 1". Check the reply card.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 18, Wisconsin.

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, coatings for exposed aggregate concrete, non meltable mastic waterstops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind.

Electric Submersible Contractor Pumps

376. Capacity curves, specifications, accessories and list prices of Flygt electric submersible contractor pumps are covered in literature from Stanco Mfg. & Sales Inc., Construction Equipment, 1666 Ninth St., Santa Monica, Calif. Check the reply card.

Modern, Welded Constructed Elevated Steel Tanks

382. Revised edition of Horton ellipsoidal elevated steel tanks of welded construction is available from Chicago Bridge & Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. The catalog is well illustrated and contains a table of standard tank dimensions for capacities ranging from 40,000 to 500,000 gals.

Deepwell Submersible Pumps for Municipal Water Supply

391. 6 and 8-in. Sumo submersible pumps are described in Bulletin No. B10001A from Sumo Pumps Inc., Stamford, Conn. Check the reply card for performance chart and specifications.

Transite Pipe for Water Systems

447. The installation, operation and maintenance economies of Transite® pipe and the Ring-Tite® coupling for pressure water lines are described and illustrated in literature offered to engineers from Johns-Manville, 22 East 40th St., New York 16, N. Y. Check the reply card for tables of weights, sizes and pressure classes.

V-Notch Chlorinator For Chlorine Flow Control

502. An 8-page catalog on the W & T Series A-721 chlorinator is available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Chlorinator is adaptable to any type of chlorinator control and feed rate may be controlled manually or automatically.

Floatless Liquid Level Controls

513. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

Data and Specifications on Aluminum Grating Walkways

531. Aluminum walkways for bridges, sewage and water treatment plants and garages are covered in bulletins available from Washington Aluminum Co., Inc., Knecht Ave. & Pennsylvania R. R., Baltimore 29, Md.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Complete Line of Earth Boring Machines

591. A 16-page illustrated catalog on the Hydrauger line of boring machines has been released. Field operation photos and views showing embankment drainage and pipe line installation are included in this material available from Hydrauger Corp., Ltd., 681 Market St., San Francisco, Calif.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Water Service Hydrants and Outdoor Drinking Fountains

661. Water service hydrants in 4 sizes, ¾", 1", 1½" and 2" and all types of outdoor drinking fountains are described in a well-illustrated, 24-page catalog from The Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati 2, O.

Manual on Valves, Fire Hydrants and Accessories

670. Complete line of Iowa valves and hydrants are covered in this manual from Iowa Valve Co., Oskaloosa, Iowa. All equipment meets AWWA specifications.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Here's how Wrought Iron Pipe cuts costs at Cleveland's Southerly Sewage Disposal Plant

Few services are as punishing, corrosion-wise, as those found in sewage disposal installations. Sludge digestion and elutrition tank pipe for example—they can be rough.

That's why Cleveland engineers specified more than 115 tons of wrought iron pipe in the city's Southerly Sewage Disposal Plant improvement program. They wanted no troublesome and expensive shutdowns due to pipe failures in inaccessible locations.

Wrought iron pipe was installed at the Southerly site in the following services: Sludge digestion and elutrition tank piping; cold water lines—1" to 2½" downspouts and leaders; all heating piping; handrailings; blower lube oil piping; perforated pipe diffusers; expansion tank piping; air piping; diesel oil piping; exhaust gas piping.

In years of service life per piping dollar, wrought iron's supremacy in severely corrosive sewage disposal services has been proven time and time again. Wrought iron's corrosion resistance stems from a structural feature duplicated in no other metal—glasslike iron silicate fibers (250,000 per cross sectional square inch)—entrained in the pure base metal. These fibers act as barriers to corrosive attack.

And to further augment these unique physical properties, Byers Research just recently developed new 4-D Wrought Iron. It is 25% *more* corrosion resistant than standard wrought iron and ferrous substitutes. It is available now in tubular and hot rolled forms for your new design and maintenance considerations. Write us for new 4-D Wrought Iron literature. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

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Corrosion costs you more than Wrought Iron

The entire improvement program is supervised by City of Cleveland's Director of Public Utilities, Emil J. Crown, and is under the direction of Commissioner of Engineering, G. W. Hamlin, and Commissioner of Division of Sewage Disposal, W. E. Gerdel. Havens and Emerson, Consulting Engineers, Cleveland, designed the Southerly project.

To order these helpful booklets check the reply card opposite page 36.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Manual on Sewer Structures

178. This is a 48-page manual on installation design, reference data and graphs showing discharge of pipe based on Manning's formulas. Also such subjects as structural durability, material durability; selection of structures; factors influencing capacity; joints and fittings; and linings for failing sewers are covered. Copies of Manual CMS-7456 are available from the Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio, or by checking the reply card.

Engineering Data on Screening Equipment

77. Water, sewage and industrial waste screening equipment is fully described in a 28-page book, No. 2587, offered by Link-Belt Co., Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable comprehensive booklet may be obtained by checking the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Buckets and Grapples For Incinerator Service

110. Bulletin provides comprehensive information on the 5 sizes of 2-line, lever arm, clamshell-type buckets: standard 2-line, tine-type grapples; equalizer arrangements and certain incinerator buckets for single drum hoists. Check the reply card or write Blaw-Knox Co., 300 Sixth Ave., Pittsburgh, Pa., today.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit. Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

Centrifugal Pumps for Liquids Containing Solids, Air or Gases

202. Ingersoll-Rand centrifugal pumps that are non-vapor-binding, self-venting, non-clogging and self-regulating are covered in literature from Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. Check the reply card for full specifications and detailed drawings.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1132 W. Blackhawk St., Chicago 22, Illinois.

Directly Readable Flow Charts for Measuring Sewage

360. Recorder gives graphic records of liquid flow directly readable in mgd or gpm over various sizes of Parshall flumes. Check the reply card or write, Leupold & Stevens Instruments, Inc., 4445 N. E. Glesan St., Portland 13, Ore., for Bulletin 24.

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

600 cubic yards of "hardpan" every 24 hours . . .

Ten minutes' maintenance every eight hours with this Blaw-Knox Clamshell Bucket

On the western shore of Lake Huron, The Roen Steamship Company uses this custom-built, 5½ cubic yard Blaw-Knox clamshell bucket to dredge 160,000 cubic yards of rock-like sand, gravel and clay for the Harrisville, Michigan Harbor of Refuge.

Ray Pesch, project engineer says, "In spite of this rugged duty, the bucket requires only normal maintenance. In 77 days of digging we've removed about 25,500 cubic yards of hardpan, including boulders up to seven tons."

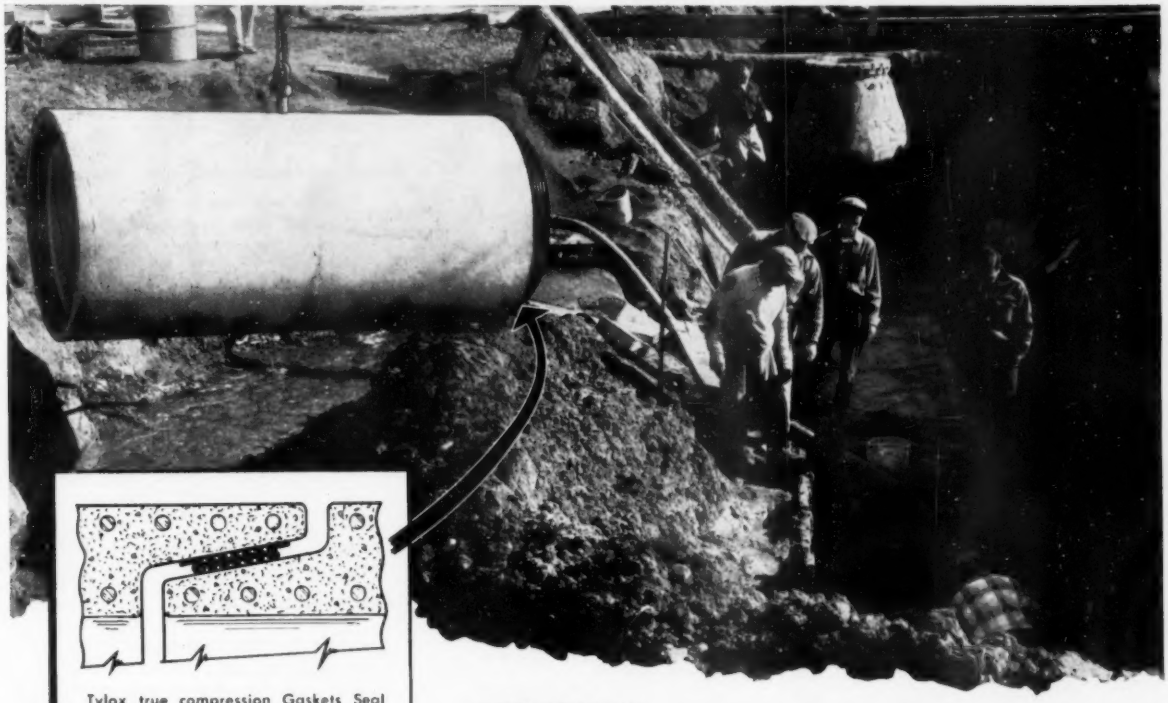
Proven on the "tough jobs" all over the world, Blaw-Knox buckets have an unsurpassed record for maintenance-free continuous service. A Blaw-Knox Bucket Engineer will be glad to help you select the best bucket for your operation. Or, you may want to write for Blaw-Knox Bulletin number 2254-R-1.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

BLAW-KNOX

Keeping new sewer lines from leaking...



Tylox true compression Gaskets Seal Water-tight for the life of the pipe itself.

TOUGH TYLOX *FLEXIBLE* PIPE GASKETS

...specified to whip tough sewer installations

This view of the Millcreek Sanitary Sewer Project clearly shows some of the tough conditions met... high water tables... flooded trenches... sandy, unstable soils.... It shows, too, how TYLOX Flexible Rubber Gaskets "join up" with sewer pipe to offset *tough* installation problems with fast pipe-laying, providing at the same time, the all-important water-tight joints necessary to meet tough infiltration specifications. When pipe is coupled with TYLOX Gaskets, trench water does not slow up the work, shifting soils do not endanger the Gasket, and the acid-resistant *compression* seal provides leak-proof joints for the life of the pipe itself.

The project, by Millcreek Township Sewer Authority, Erie County, Pa., is a $4,000,000-plus project including 45 miles of sewer laterals, trunks, mains and pumping stations. Engineering is by Consoer, Townsend & Associates, Consultants, Chicago, Ill., and Fred Gorenflo, Resident Engineer, Erie, Pa. Contractors are Berlanti Construction Co., Harrison, N. Y., and Milano Construction Co., Erie, Pa. Pipe using TYLOX Gaskets was furnished by Concrete Pipe Company of Ohio.

5129

Whether you are planning pipe lines of B & S, T & G or Recessed pipe, of any size, there's a TYLOX Rubber or Neoprene Gasket in the Hamilton Kent family of flexible true compression Pipe Joints to meet your specifications. Write for engineering details.

HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant St. ORchard 3-9555

CANADIAN PLANT: 10 BRUSSELS ST., NEW TORONTO, ONT., Phone CLifford 1-2494

To order these helpful booklets check the reply card opposite page 36.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Up-Sewer Chemical Rotation Method Controls Odors and Insects

542. By using the Cloroben Up-Sewer Rotation Method, accumulated grease deposits and slime formations are dissolved; sulfide production and roaches eliminated in laterals, branch sewers, lift stations, wet wells and force mains. This method is an effective and economical means of assuring the delivery of a non-septic, stabilized influent to the treatment plant. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearny, N.J. for your copy.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.

How to Choose the Right Self-Priming Centrifugal Pump

427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs.

4-D Wrought Iron for Building Drainage Systems

551. A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

Small Unit Sewage Treatment For 20 to 5000 People

568. Bulletin 135A describes the Rated-Aeration process, a low cost, odorless, trouble-free sewage treatment process. Check the reply card or write Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill.

Press-Seal Rubber Gaskets to Seal Joints of Concrete Pipe Sewers

623. Rubber gaskets for sealing the joints of concrete sewer pipe are described fully in literature available from Press-Seal Corp., P. O. Box 482, Fort Wayne, Ind. Check the reply card for information on how these gaskets prevent water infiltration in sewer lines.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

STREETS AND HIGHWAYS

Four Wheel Drive 1¼ yd. Front End Loader

115. The Trojan 1¼ yd. loader for heavy-duty bulk materials handling is covered in bulletin available from Contractors Machinery Div., The Yale & Towne Mfg. Co., Batavia, N. Y. Check the reply card.

Chip Dollars from Your Overhead With Fitchburg Chippers

160. Detailed cutaway drawings, specifications, diagrams, charts and money-saving reports and experiences are covered in catalog available from Fitchburg Engineering Corp., Dept. PW, Fitchburg, Mass.

Concrete Pavement Manual Offered

171. Details of design and principles of concrete pavement construction are presented in a 78-page manual published by the Portland Cement Assn., 33 W. Grand Ave., Chicago 10, Ill. Data from many sources is summarized in convenient form to help design and construction engineers. Check the coupon for your copy.

Sand and Cinder Spreaders For Streets and Highways

175. PTO with mechanical or hydraulic operation and auxiliary engine with mechanical or hydraulic operation are the choice of drives on these sand and cinder spreaders. Check the reply card or write Baughman Mfg. Co., 152 Shipman Road, Jerseyville, Ill., for complete catalog.

Catalog on Tractor-Driven Tailgate Spreader

182. Highway Equipment spreader spreads in the echelon pattern for ice control and the blanket pattern for seal coating. For literature write Highway Equipment Co., Dept. H41 616D Ave. N. W., Cedar Rapids, Iowa.

PORTABLE SPRAYER

TARCO "Portable Vac-U-Sprayer"

Do **more and better work** with this **light weight, simple-to-operate, inexpensive** spray outfit.
Ideal for: **Concrete Curing. Building** perfect **contoured patches. Constructing** driveways, parking lots, walks, tennis courts. **Waterproofing** foundations, roofs. **Subsealing** pavements.
Uses gasoline engine driven, positive displacement pump. Has built-in material screen, adjustable pressure regulator and by-pass. Sucks and sprays liquids direct from any container. Comes complete with assorted nozzles, 25 ft. spray hose and hand gun. Multiple-head, tail-gate spray bar and weed control spray guns available.

Let your dealer or us give you complete details on this and other TARCO paving equipment.

TARRANT MFG. CO.
28 Jumel Place, Saratoga Springs, N. Y.

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1-Pc. Aluminum Guides & Stop Plates or Sluice Gates

Mean Easy Installation, Greater Economy!

The one-piece construction of our aluminum guides eliminates clumsy machine grooved or riveted flat bar assemblies. Their ease of installation and low cost (on a per foot basis, less than that of steel or other metals) are points to consider.

Strong, durable, non-corrosive qualities of Aluminum make it important to Water and Sewage. *Washington Aluminum Engineers are available for discussion of design problems on any installation at point of planning. No obligation.* Write for nearest representative.

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Dept. 573 • Baltimore 29, Md. • Phone Circle 2-1000

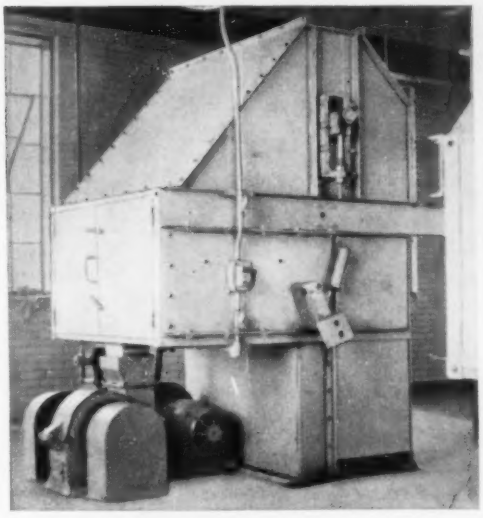
WHICH SCREEN

is best for your job?

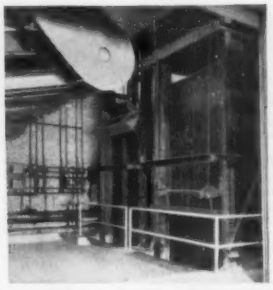
LINK-BELT builds a complete line for efficient removal of solids

COARSE?

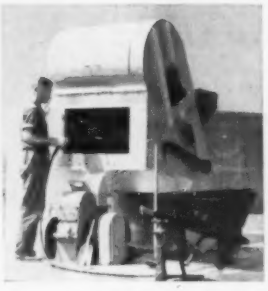
Link-Belt coarse screens, commonly known as bar screens or racks, are preferred in water, sewage and industrial waste treatment plants where the water contains a considerable volume of large solids that might damage or clog subsequent equipment. They consist of a series of parallel bars in the flow channel —either vertical or inclined.



THRU-CLEAN BAR SCREENS. Automatic, chain operated rakes clean from down-stream side . . . eliminate jamming by debris. Vertical or inclined bars.



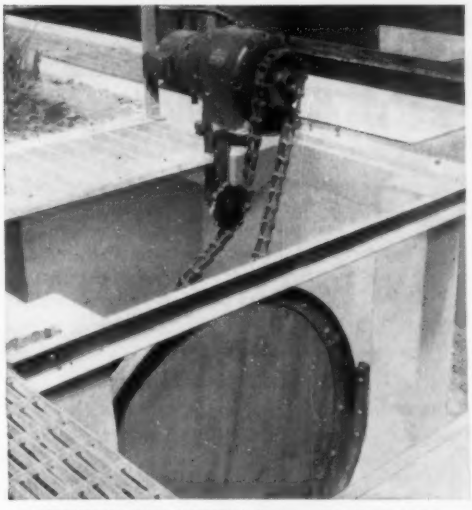
STRAIGHTLINE BAR SCREENS. Automatic, jam-proof, cable-operated rake cleans from up-stream side, assures clean, positive screenings removal.



TRITOR SCREENS. Combined screen and grit chamber saves smaller plants the cost of separate units to remove large solids and grit.

FINE?

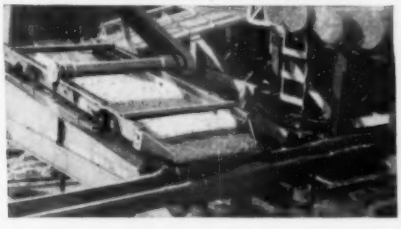
Link-Belt fine screens provide for efficient removal of small solids. They protect subsequent equipment, prevent pollution of streams and often recover valuable products. These screens use a relatively fine mesh cloth making them applicable to water intakes, industrial waste treatment and industrial solids recovery.



REVOLVING DISC SCREENS. For applications similar to rotary drum screens, but where volume is less. Easily installed.

ROTARY DRUM SCREENS. Effectively remove fine solids from large volumes of water. For fixed water level installations.

LIQUID VIBRATING SCREEN. For thorough removal and dewatering of fine solids with minimum blinding of screen cloth.



Efficient water and waste treatment begins with a Link-Belt screen. This broad line is your assurance of an impartial recommendation based on the specific nature of your waste. For more data, contact your nearest Link-Belt office or write for Screening Equipment Book 2587.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 15,010

To order these helpful booklets check the reply card opposite page 36.

Illustrated Specifications on Brush and Limb Disposal

222. A new booklet on the modern approach to the brush problem shows how an Asplundh chipper reduces bulky branches and brush trimmings to chip size for mulch or easy removal. Write Asplundh Chipper Company, 505 York Road, Jenkintown, Pa., or use the handy reply card.

All-Purpose Construction Tractor With "Spot-Turn" Clutch Steering

231. "Spot-Turn" steering enables the Oliver crawler tractor to have a very short turning radius. Complete specifications in literature from The Oliver Corp., Industrial Div., 19300 Euclid Ave., Cleveland 17, Ohio, or by checking the reply card.

Manual on the Use and Application of Compactors

261. A Manual covering the various types of compaction equipment in use today and including rollers and vibratory compactors is available from The Galion Iron Works & Mfg. Co., Galion, O. Check the reply card for details on the problems encountered in the efficient compaction of various materials, and the correct use of compaction equipment available.

The Principles of Compaction by Vibration

288. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Sante Fe Ave., Los Angeles, Calif.

How To Build Stabilized Heavy Traffic Pavements

300. A 16-page booklet published by Seaman-Andwall Corp., 13050 West Blue Mound Rd., Elm Grove, Wisc. shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worthwhile booklet for every highway engineer.

Manual on the Use of Calcium Chloride

301. This manual presents the physical and chemical properties of the new pellet-type calcium chloride and its water solutions. Also, gives complete data on shipment, handling and storage. Check the reply card or write The Dow Chemical Co., Midland, Mich., for your copy.

Manual on Steel and Wire for Road Building

337. Design data on wire fabric for concrete pavements, joint data, guardrail design standards, steel and wire for concrete pipe and reinforced bituminous concrete design are some of the sections covered. Check the reply card or write American Steel & Wire Div. of United States Steel Corp., Cleveland 13, Ohio, for this valuable manual.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or check the reply card.

Data on Eimco, the Modern Crawler Equipment

358. Front end loaders, dozers, and fork lifts are some of the attachments available for the Eimco tractor. Check the reply card or write The Eimco Corp., Salt Lake City, Utah, for facts and qualified engineering assistance.

64-Page Manual On Surface Treatments

484. Complete up-to-the-minute information on all types of surface treatments is covered in manual available from American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif. The Manual provides on-job reference as well as engineering department use and it covers every step from pavement inspection to traffic-control on the finished pavement. Check the reply card.

Hand Operated Soil Sampling Kit

366. Bulletin 26-R describes the Acker soil sampling kit that contains 12 different soil sampling tools packed in a handy steel case. Check the reply card or write to Acker Drill Co., Inc., P.O. Box 830, Scranton 2, Pa., for data on tools that are designed to take soil samples from practically any material.

Data on Transits for Engineering Departments

367. K&E Paragon transits are covered in literature available from Keuffel & Esser Co., Dept. PW, Hoboken, N. J. Transits have enclosed achromatic telescope, chrome plated draw tube, stainless steel axle journals, one-piece spanned vernier disc and chrome plated center.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

What's Your Digging Problem? Repair Work? Trenches? Footings?

518. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam; work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 180° arc and dig to a depth of 12 feet. For full details check the reply card. Sherman Products, Inc., Royal Oak, Mich.

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

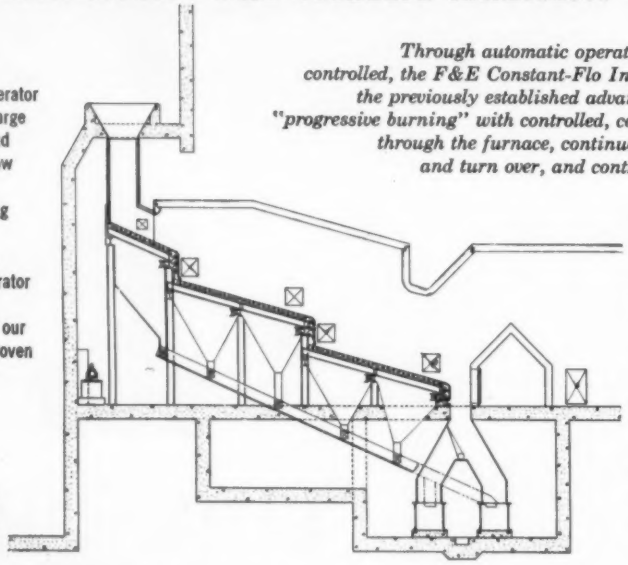
550. Size and weight tables, minimum gages for live load strutted and unstrutted, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa., or check the reply card today.

F&E Constant-Flo Incinerator Stoker

Companion Stoker—F&E Standard Incinerator Stoker

In addition to the F&E Standard Incinerator Stoker for batch charge plants, the Flynn and Emrich Company now offers for those municipalities calling for "Constant-Flo" operation, the F&E Constant-Flo Incinerator Stoker, using the latest application of our already tried and proven F&E Incinerator Stokers.

Through automatic operation, electronically controlled, the F&E Constant-Flo Incinerator Stoker combines the previously established advantages of F&E "progressive burning" with controlled, constant flow of material through the furnace, continuous agitation, break up and turn over, and controlled residue disposal.



RESULTS—

1. *Reduction of plant operating personnel to absolute minimum,*
2. *Higher rates of destruction with less air pollution,*
3. *Controlled furnace temperatures with much lower furnace maintenance than previously attainable, and*
4. *Refuse reduced more thoroughly at lower cost.*

F&E

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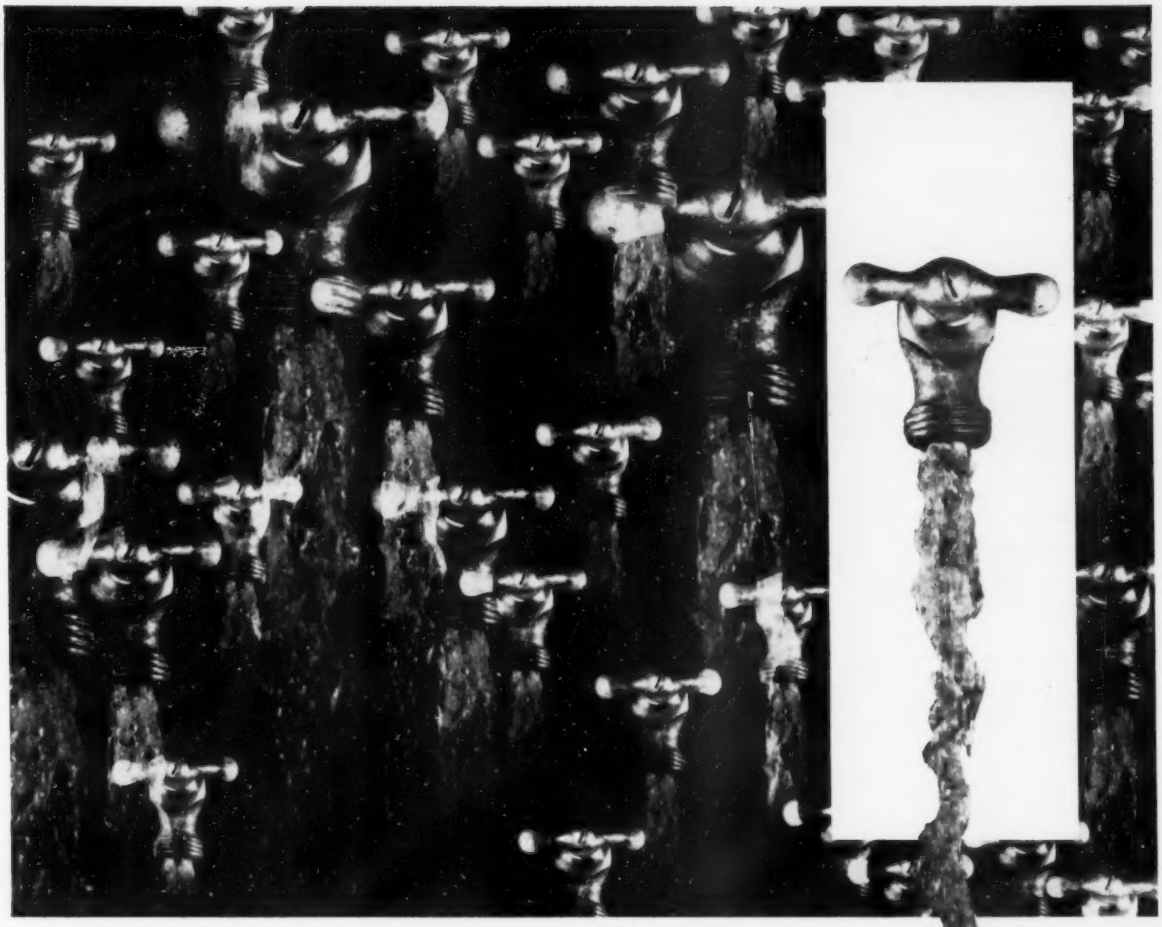

450-1 flow range

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SPARLING BROAD GAUGE COMPOUND METERS

No conversion; no duplication; no wasted water... Sparling Broad Gauge Compound Meters provide the broadest range of accurate metering available, with all flows *registered on one totalizer.*

LOW FLOWS, down to 2.5 gpm, are registered with the positive accuracy of a displacement meter... **HIGH FLOWS** utilize the exclusive Sparling propeller meter design for maximum accuracy and minimum head loss. Flows metered up to 2250 gpm are standard... **TOTAL FLOWS** up to a 450 to 1 range are registered on one common 6 digit straight-reading totalizing register within 2% accuracy. Available in sizes 6"x 1½", 8"x 2", 10"x 2", 12"x 2".

Write for Technical Bulletin No. CF 333-1

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SPARLING METER COMPANY *225 N. Temple City Blvd., El Monte, California*

Atlanta 3 • Chicago 4 • Cleveland 13 • Dallas 1, Tex. • Denver 6 • Kansas City 6, Mo. • Roselle, N. J. • San Francisco 24 • Seattle 99 • Romford, England

To order these helpful booklets check the reply card opposite page 36.

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y.

Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 110 Nr. Wacker Drive., Chicago 6, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

Helpful Data on Distributors for Bituminous Materials

611. Pressure distributors featuring uniform pressure and temperature, accurate displacement pumping, convenient operation are described in literature of Standard Steel Works, North Kansas City, Mo.

How Good Are Your Truck Drivers? The Tachograph Will Tell You

682. Accurate records of truck engine operation are made available by the Tachograph. Find out how savings and safety can be promoted by getting Bulletin SU-3 from Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo. Details of construction and descriptions of operation are included.

Sweepers Handle A Variety of Jobs In Every Season

684. Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wisc. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

REFUSE COLLECTION AND DISPOSAL

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Refuse and Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Information on the Hydepak Refuse Packer

437. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hydepak Division, Hobbs Trailers, 609 No. Main, Fort Worth, Tex., or check the reply card.

WEED, DUST & INSECT CONTROL

Investigate "Tifa" For Insect Control

47. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use reply card for full data on public health programs. Products Div., Todd Shipyards Corp., Columbia & Halleck Sts., Brooklyn 31, N. Y., Greens Bayou, Houston 15, Texas.

How to Stop Bothersome Dust

433. A bulletin that covers the use of calcium chloride in the control of dust is available from Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich. Tables on the use of calcium chloride pay are included. Check the reply card.

Control Weeds and Brush Along Highways

640. Literature from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, describes how use of weed and brush killers help reduce accidents and also included is a handy, ready-reference control chart that covers weed control problems, quantity of solution to use and economical application. Check the reply card.

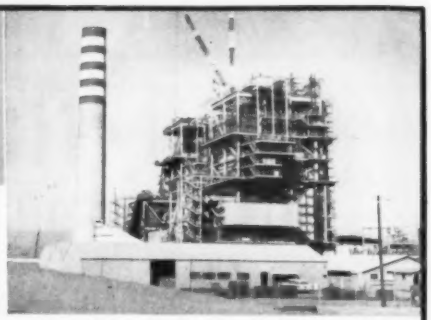
RECREATION

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.

FOR UTILITIES and GOVERNMENT AGENCIES

DE-WATERING PROBLEMS LICKED with FLYGT Submersible Electric Pumps



Public Utilities and Government Agencies throughout the world find FLYGT SUBMERSIBLE ELECTRIC PUMPS tops in performance on any de-watering problem. Public Works users like FLYGT foolproof features, the advantage that the pumps work in any position, and the fact that they do not clog up. They can take a lot of solid stuff like mud and sand without hurting them in any way. The rubberized pump casings and hard chrome alloy impellers combine to make FLYGT PUMPS rugged equipment which works 24 hours a day with little or no attention. Low in initial cost . . . low in operating expense, FLYGT PUMPS will save you money.

FLYGT SUBMERSIBLE ELECTRIC PUMPS range in size from 1½"-85 GPM capacity to 8"-3000 GPM capacity. Head capacities range up to 210 feet. Higher heads obtainable with FLYGT PUMPS in tandem. Weights range from 70 to 1200 pounds. Write for complete specifications.

Near Los Angeles, California, the immense Steam Generating Plant illustrated above produces more electricity than Hoover Dam, and when completed it will be one of the major sources of electric power in the entire West. This plant uses two FLYGT models B-80 and one B-38L for a variety of around-the-clock de-watering applications. Operating at the bottoms of sumps and excavations, the FLYGT PUMPS keep strategic areas free of salt-water intrusion and seepage from storm water run off. The FLYGTs often pump a high proportion of solids, and have proven resistant to salt water.

CHECK THESE FLYGT FEATURES

- Electric, fully submersible, fully portable.
- Instant pumping — no priming, no installation.
- Runs dry without damage, resistant to salt water.
- Takes a high proportion of solids, frost and fire-proof.
- Practically no maintenance or supervision.
- Operates unattended, quick and easy to service.

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FLYGT

WEST OF THE MISSISSIPPI:

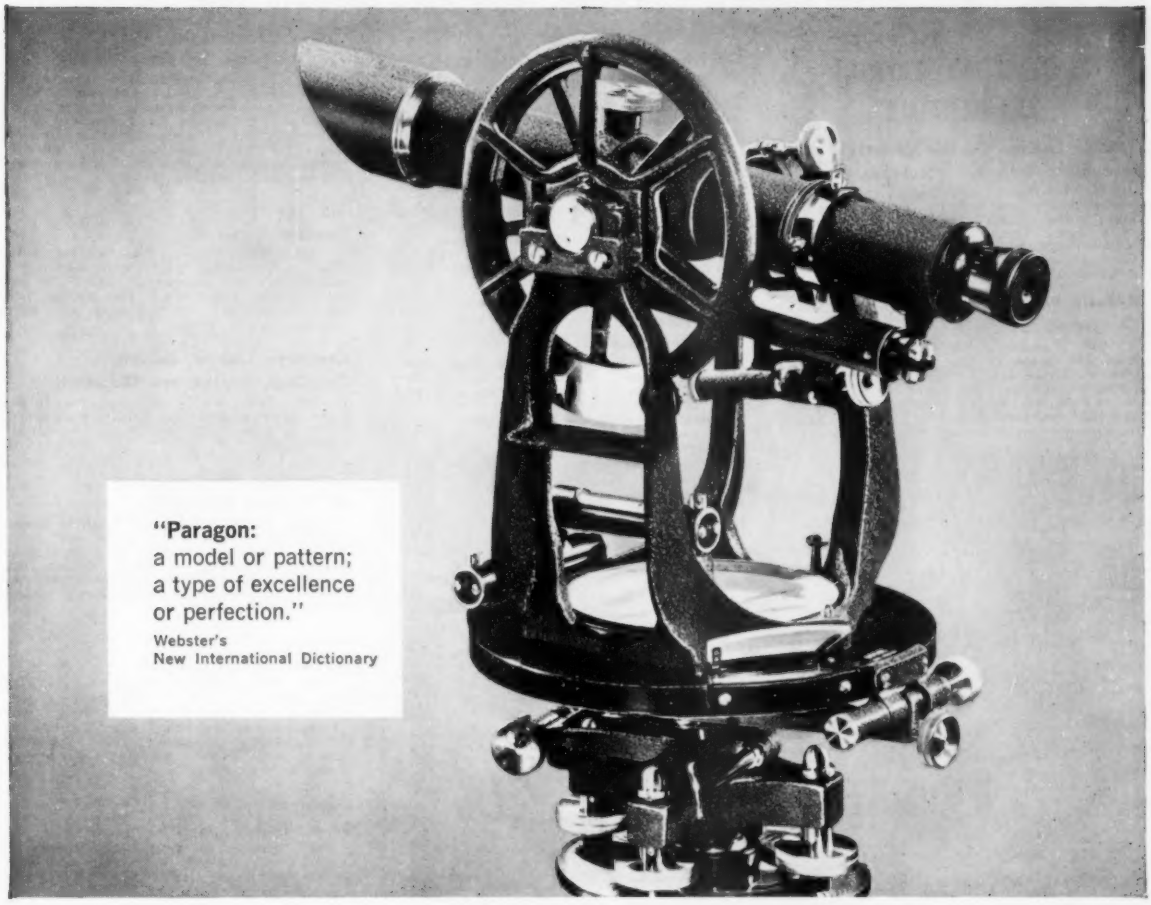
Stancs MFGS. & SALES INC.

1666 Ninth St.
(Corner of Olympic & Ninth)
Santa Monica, California.

EAST OF THE MISSISSIPPI:

STENBERG MANUFACTURING CORPORATION

Hoosick Falls, N.Y.



In Transits too, K&E Paragon sets the pattern of perfection

The superior optical qualities and precision operation which K&E builds into the Paragon Transit® are designed to last a lifetime and offer the maximum in performance and ease of use. Compare the Paragon with other transits, feature by feature. Only the K&E Paragon Transit has all five of these important advantages:

1. A Completely Enclosed Achromatic Telescope . . . with an achromatic eyepiece *as well as* an achromatic objective lens. It sights clearly and sharply, with less eye strain. Enclosed telescope is fully sealed, stays free from dust and moisture.

2. Chrome Plated Draw Tube . . . with one of the hardest bearing surfaces known to man. Tube cannot wear as it moves back and forth on bearing rings, so line of sight remains stable.

3. Stainless Steel Axle Journals . . . for the best possible bearing surface. Ease of operation is retained no matter how many times you change the telescope from the direct to the reverse position.

4. One-Piece Spanned Vernier Disc . . . to make sure that the verniers always stay exactly 180 degrees apart. Even under the roughest, most demanding field conditions, angle readings of the Paragon Transit will stay true.

5. Chrome Plated Center . . . combines the toughness of non-brittle forged Everdur with the hardness of chrome.

Naturally, because the K&E Paragon Transit is the best, it costs a little more than ordinary transits. But see for yourself how much more it has to offer. A call to your K&E representative will quickly arrange for a demonstration. Fill out and send in the coupon below.

1612

K+E

KEUFFEL & ESSER CO. Dept. PW-5 Hoboken, N. J.

Gentlemen: ☐ Please have a K&E representative show me the K&E Paragon Transit.
☐ Please send me more information about the K&E Paragon Transit.

Name & Title _____

Company & Address _____

_____

To order these helpful booklets check the reply card opposite page 36.

•

CONSTRUCTION EQUIPMENT AND MATERIALS

Tractor Loader Can Be Converted Into Eight Different Machines

38. Multiple-purpose tractor loader can be converted to a street sweeper, backhoe, fork lift, angle dozer, crane and rotary broom in a short time. Check the reply card or write Massey-Ferguson Industrial Div., 1009 South West St., Wichita 13N, Kans., for well illustrated catalog.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Austin-Western Construction Equipment Catalog

260. Power graders, street sweepers, road rollers, crushing and screening plants and hydraulic cranes are covered in catalog from Austin-Western, Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Aurora, Ill.

Case Utility 310B Backhoe-Loader

282. The Case wheel-mounted backhoe-loader is described and illustrated in 8-page, 3-color Bulletin CUS-110, released from J. I. Case Co., Racine, Wis. Check the reply card for mechanical details of the backhoe, loader and heavy-duty tractor.

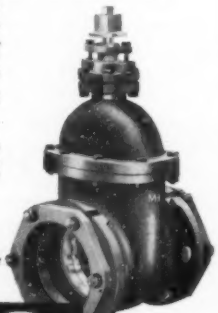
Barber-Greene Continuous Asphalt Plants

320. This catalog covers the Model 848-A asphalt plant and presents each typical plant setup and separately shows the details of each component. Check the reply card or write Barber-Greene, Aurora, Ill., for your copy.

WHAT BECAME OF TYPHOID?

Not until after 1900 (about 55 years ago) did U. S. citizens really accept public water supply systems as sources of potable water. Scientists discovered water borne disease germs in 1875. It then required about 30 years for the people to believe that such serious diseases as dysentery, cholera and typhoid fever epidemics were due to germs in their drinking water. Finally they realized that water could be clear, cold and fresh tasting, yet dangerous to drink. The water works industry therefore built treatment plants . . . sand filters and chemical feeders. The public abandoned private wells. Today, water-borne disease in America has virtually disappeared. In some 50 years, the U. S. typhoid death rate has dropped from 200 to less than 1 per 100,000 persons. Hippocrates, the "Father of Medicine", in 400 B. C., told the Greek people to boil water before drinking it, but today America's public water supplies are safe.

The water works superintendent in a real sense today is a custodian of public health and a vital force in the Nation's economy.



This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

3-5 Ton Tandem Roller

341. Huber-Warco 3-5 ton tandem roller is designed for smaller rolling operations such as parking lots and driveways. Check the reply card or write Huber-Warco Co., Marion, Ohio, for Bulletin HWT 536 that gives complete information on this roller.

Complete Line of Shovels, Draglines, Cranes and Clamshells

361. Bucyrus-Erie crane-excavators in sizes from ¾ to 4 cu. yd. capacities are covered in literature from Bucyrus-Erie Co., South Milwaukee, Wis.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

A Completely Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included.

Basic Fundamentals of High-Speed Earthmoving Techniques

617. This bulletin illustrates and explains the major factors in earthmoving equipment selection. Check the reply card or write the Advertising Division of Caterpillar Tractor Co., Peoria, Ill., for charts and performance characteristics.

Vertical Augers and Horizontal Diggers For Construction Work

644. Prewitt diggers are 2 types, a horizontal boring machine for tunneling work and a vertical rig for pole or post holes, digging up to 6½ ft. Check the reply card or write to J. R. Prewitt and Sons, Inc., Dept. 508, Pleasant Hill, Mo., for full details.

Portable Water Coolers Used on Maintenance and Construction Work

651. Igloo cans and coolers are permalined and range in capacity from 2 to 15 gals. Models and sizes are covered in bulletin available from Igloo Corp., P. O. Box 8227, Memphis 4, Tenn., or by checking the reply card.

COMPARE

More Capacity At Less Cost With R-C Rotary Gas Meters

R-C rotary gas meters are available in a wide range of sizes delivering "cash-register" accuracy in capacities from 2,000 to 1,000,000 cfh at pressures to 600 psig and are ideally suited for commercial, institutional, industrial, interplant accounting and pipeline metering.

Comparative Analysis	SPACE OCCUPIED	TOTAL CAPACITY	METER COST	INSTALLING COST	TOTAL COST
FOUR DIAPHRAGM METERS					
ONE R-C METER					

As the comparative chart indicates, cost is reduced and capacity is increased with R-C rotary positive displacement meters. The total capacity of one R-C meter exceeds that of two or more diaphragm meters. Both initial cost and installing costs are substantially lower. Their small space requirements permit installation in otherwise unusable space. And operating costs are held to a minimum, since maintenance is confined almost entirely to lubrication of gears and bearings and to an occasional check of the operating differential.

Roots-Connersville rotary positive displacement gas meters provide a 15:1 operating range – metering unmatched by any other design. Precision-machined measuring chambers insure unalterable accuracy unaffected by variations in specific gravity, rate of flow, pulsations or impurities. And there are no valves, diaphragms or other small parts to wear and cause inaccuracies.

Pressure drop is minimized, since R-C's straight-through design eliminates winding passages and restricting ports. Even at low flows, these meters retain "cash-register" accuracy. These advantages are the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.

For additional data, please refer to pages 565-568 in **Chemical Engineering Catalog**, *our section in* **Mechanical Catalog** *or write for* **Bulletin M-258**

ROOTS-CONNERSVILLE BLOWER
DIVISION OF DRESSER INDUSTRIES, INC.
559 Poplar Ave., Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto

To order these helpful booklets check the reply card opposite page 36.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Data on Portable and Stationary Air Compressors and Accessories

652. Covered in literature available from Gordon Smith & Co., Inc., Bowling Green, Ky., are the basic designs of portable air compressors, models, operating features and specifications. Check the reply card.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Expansion Joints Used In Concrete Construction

680. Asphalt, fibre, corkfill and sponge rubber expansion joints are covered in catalog on Sealtight joints and other top-quality Sealtight products available from W. R. Meadows, Inc., 25 Kimball St., Elgin, Ill. Check the reply card for data on how these expansion joints are used in pavements, runways, bridges, ramps and other concrete structures.

Tractors and Equipment for Municipal Use

407. Specification sheets for the John Deere crawler and utility wheel tractors; also equipment for loading, dozing, mowing, sweeping and many other operations. John Deere, Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

WISCONSIN-powered offset mower cuts rank growth...trims costs!

THE MODEL BKN that powers this mower, delivers 7 hp at 3600 rpm. It has tapered roller main bearings; high-tension outside magneto with impulse coupling; pump-circulated lubrication; and large-capacity cooling fan. Electric starting available on all models.

...Model BKN Wisconsin engine gives long life... improves efficiency.

This handy Wisconsin-powered offset mower built by Kut-Kwick Tool Corp., Brunswick, Ga., enables you to cut grass, weeds, manhours, and costs in one swoop! It mows around and under obstacles—gets close to posts and markers, under fences, etc., on the first pass, thus minimizing and often eliminating manual trimming.

The BKN engine is built for long, dependable service. Its *workhorse* drive enables the mower to breeze through the heaviest growth without stalling. Air-cooled design packs more power into less engine mass and weight — makes the mower easier to handle. High-tension magneto with Impulse Coupling assures fast starts and steady performance at all times.

You can cut the cost of turf maintenance by standardizing on Wisconsin-powered equipment. Specify Wisconsin engines on new equipment. Insist on "WISCONSIN" to replace worn-out engines. Write for Form S-222 describing the BKN — or Form S-237 covering the entire Wisconsin line of single-, two-cylinder, and four-cylinder V-type engines — 3 to 56 hp.

WISCONSIN MOTOR CORPORATION
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

STREET LIGHTING AND TRAFFIC CONTROL

Engineering Data on Aluminum Lighting Standards

256. Latest designs and applications of all-aluminum, seamless, tapered lighting standards, and elliptical lighting brackets plus detail drawings and mechanical specifications are provided in a comprehensive 16-page bulletin issued by Pfaff & Kendall, 84 Foundry St., Newark, N. J.

New Reflectorized Sign Faces Refurbish Old Traffic Signs

292. Get complete details on new "Ez-On" traffic sign faces ready for immediate shipment. Reflectorized faces cost about one half as much as new signs and are easily attached to existing traffic signs. Grace Sign & Mfg. Co., St. Louis 18, Mo.

3M Letters for Large Reflectorized Signs

374. "3M Signal" letters are made with "Scotchlite" reflective sheeting encapsulated in acrylic plastic and are used on large reflectorized signs. Check the reply card or write Minnesota Mining and Mfg. Co., St. Paul 6, Minn., for full details.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave. S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

Street Lighting Poles for Streets and Highways

443. Standard designs, assembly details, suggested pole sizes, base construction details and bracket arm details are some of the details covered in this 22-page catalog. Check the reply card or write The Union Metal Mfg. Co., Canton, Ohio, for Catalog No. 78-A on street lighting poles of modern designs for all streets and highways.

Aluminum for Complete Line of Signs and Sign Blanks

675. Valuable information on aluminum's advantages, features and economies, plus details on application of all sign message materials are covered in the aluminum sign bulletin from Kaiser Aluminum & Chemical Sales, Inc., Dept. MU-936, 919 N. Michigan Ave., Chicago 11, Ill. Check the reply card today.

BUSINESS ADMINISTRATION

Copymaker for Every Office, Business and Department

686. Catalog available from American Photocopy Equipment Co., 2100 West Dempster St., Evanston, Ill., is well illustrated and points out the applications and advantages of copy machines for every business.

FITCHBURG CHIPPER

"OPERATES 1693 HOURS without a breakdown of any kind!"

WELDON S. CAMPBELL
64 MUNSON STREET
GREENFIELD, MASSACHUSETTS

February 4, 1958

Fitchburg Engineering Corporation
Fitchburg, Mass.
Mr. Perini, Superintendent

Dear Sir:

On March 23, 1955, we purchased one of your Chippers. You may be interested to know that this machine operated a total of 1,693 hours without a breakdown of any kind. Inasmuch as we are paid for running time only we often start up the chipper 20 or more times daily.

We have followed faithfully your instructions in using a hone on the knives each morning, we find that by doing this we can use the knives for five weeks before sharpening. Even then only about 12 thousands are needed to bring them back.

Contractors find your chipper is ideal and saves them much time and dollars in clearing a woodland area before bull dozing begins.

Your Engineering skill and knowhow has resulted in the finest of all Chippers and I have seen them all in operation.

Hauling time is reduced two-thirds, this results in a large saving in gasoline, parts and labor. I would never again be without one.

Respectfully,

Weldon S. Campbell
Tree Warden & Moth Supt.
Greenfield, Mass.

"Our Fitchburg Chipper has been inexpensive to maintain and trouble-free in operation, and has meant a great saving to us in time and labor."
—F. A. Canuse & Sons, Inc.
Philadelphia, Pennsylvania

"During about 2,000 operating hours we have suffered neither employee accident due to chipper operation, nor major mechanical failure."
—Northern Tree Company, Inc.
Petoskey, Michigan

"The Fitchburg Chipper is well constructed. The machine is trouble-free and easily maintained."
—John Glasgow, Supt. of P. W.
Township of Mahwah, New Jersey

Fitchburg Wood Chippers are engineered to stand hard use, to give long service without excessive maintenance costs.

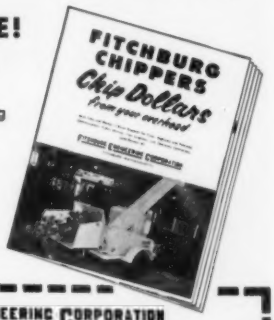
That's the "reason why" successful men like Weldon Campbell prefer Fitchburg for the tough brush removal jobs.

Fitchburg Chippers are designed by engineers for busy, trouble-free service. The exclusive spring-activated feed plate adjusts itself automatically—provides protection from damaging foreign material—assures smooth, efficient operation. The power take-off clutch gives safe starts and stops. There's no fly wheel to cause bearing trouble. These features keep a Fitchburg Chipper on the job . . . save you time and money.

Read (at right) what others say about their Fitchburg Wood Chippers, and send for your free copy of "Chip Dollars" today.

NEW! FREE!
Book of Facts

Detailed cutaway drawings of Fitchburg Chipper in color. Specifications, diagrams, charts, plus money-saving reports and experiences of others.

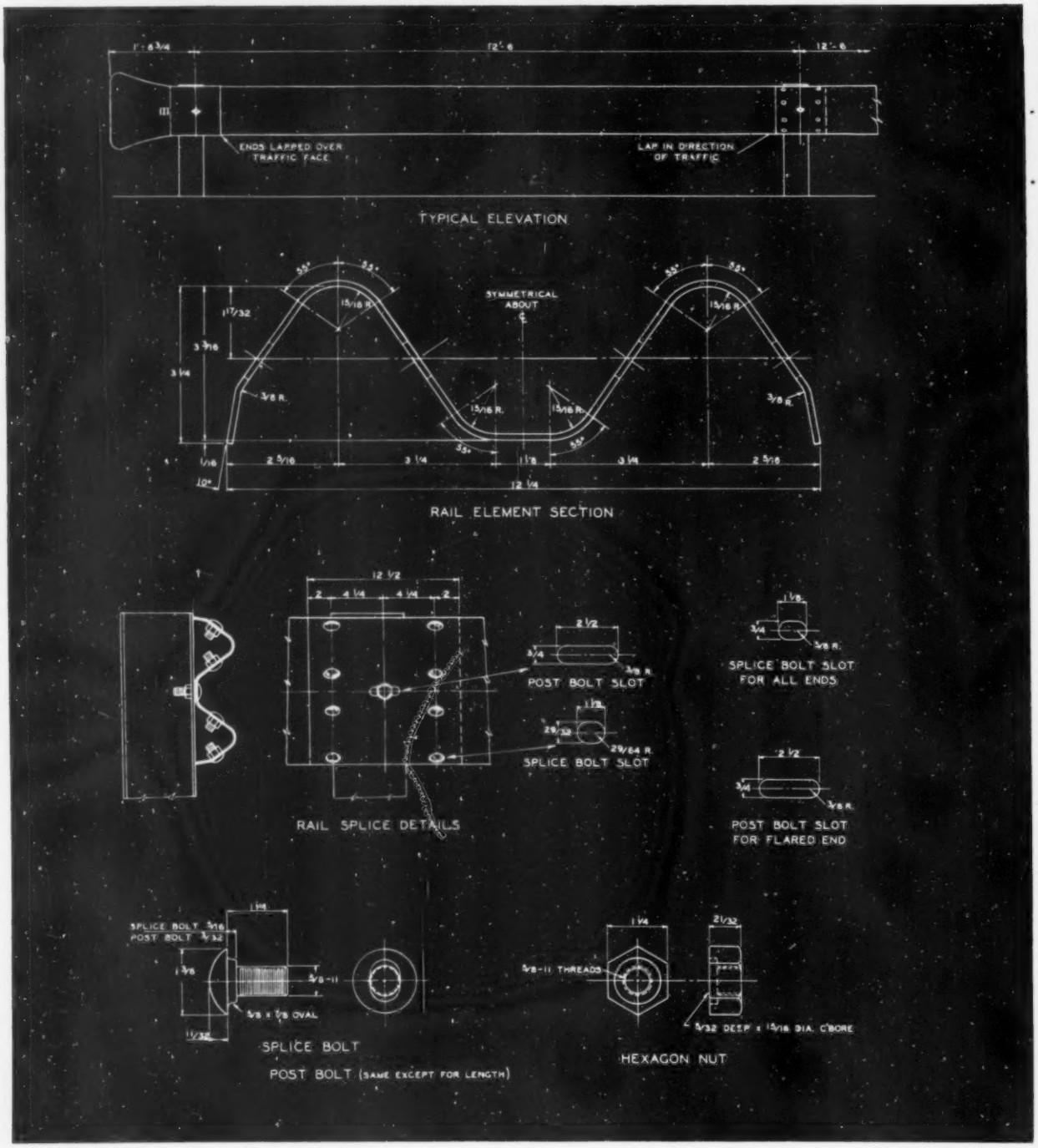


FITCHBURG ENGINEERING CORPORATION
Fitchburg, Mass., Dept. PW-59
Send Free Copy of "Chip Dollars from Your Overhead."

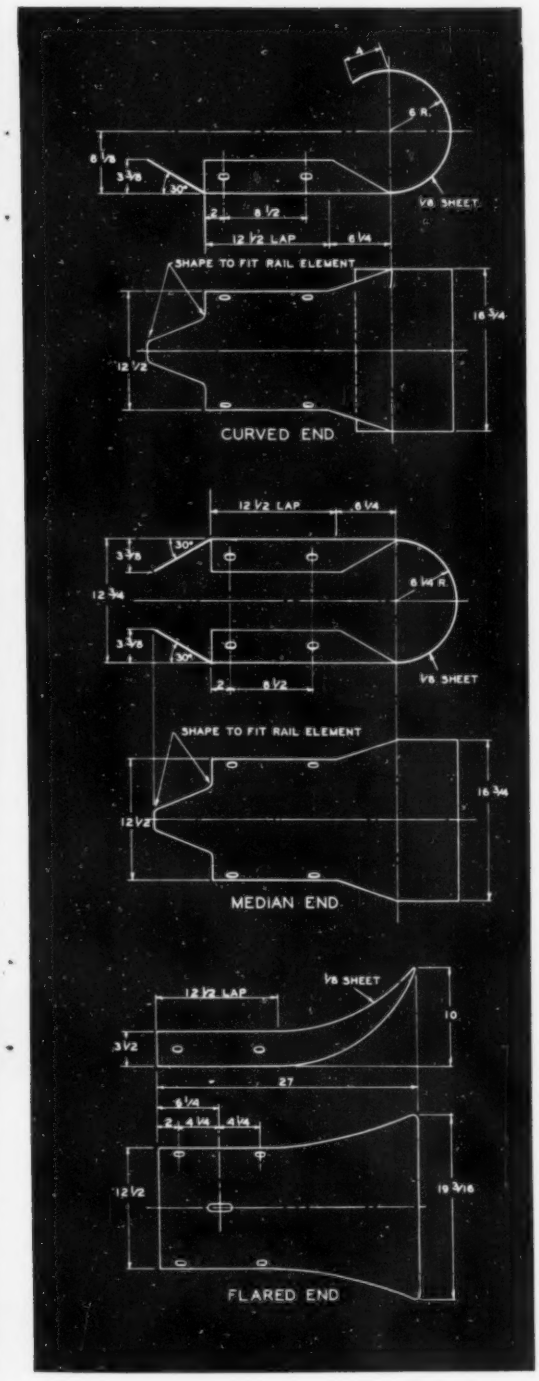
Name.....
Position.....
Company.....
City or Town.....State.....

FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.

NEW ALCOA ALUMINUM BEAM GUARD RAIL ENDS MAINTENANCE



The story's in the "specs"



General. Alcoa® Aluminum Beam Guard Rail shall consist of rail elements fabricated to develop continuous beam strength and shall be installed as shown on the plans.

Description. The rail element shall consist of aluminum sheet formed into a beam not less than 12 in. wide and 3 in. deep, in accordance with the standard drawing. The cross section shall consist of two corrugations symmetrical about the horizontal axis, with the rounded faces turned toward traffic and the edges turned away from traffic. The edges and the center of the rail shall contact each post. Splices shall be bolted and lapped not less than 12½ in. Each end of every installation shall be fitted with a terminal section as shown on the standard drawing.

Material. The rail elements shall be formed from aluminum alloy Alclad 2024-T3 sheet (ASTM Specification B209, latest issue, alloy clad CG42A, condition T3). The terminal sections shall be formed from aluminum alloy Alclad 2024-O sheet (ASTM Specification B209, latest issue, alloy clad CG42A, condition O). All bolts shall be aluminum alloy 2024-T4 with 204 Alumilite* finish. The bolts shall be made from rod conforming to ASTM Specification B211, latest issue, alloy CG42A, and shall be supplied in the T4 temper. Bolt head and thread dimensions shall conform to the standard drawing.

All nuts shall be aluminum alloy 6061-T6 made from rod conforming to ASTM Specification B211, latest issue, alloy GS11A, condition T6. Nut and thread dimensions shall conform to the standard drawing.

Strength. The rail element shall be designed to meet the requirements of the following table. The post connection shall withstand a 5,000-lb side pull in either direction.

*Trade Name of Aluminum Company of America

Nominal Thickness in.	Minimum Tensile Strength of Joint lb	Beam Strength†			
		Traffic Side Up		Traffic Side Down	
		Load, lb	Max. Deflection in.	Load, lb	Max. Deflection in.
0.105	65,000	1,200 1,800	3½ 5½	1,000 1,400	3½ 5½
0.125	80,000	1,500 2,000	3½ 5½	1,200 1,600	3½ 5½
0.156	100,000	2,000 3,000	4 6	1,600 2,400	4 6

†With the rail element freely supported on a 12-ft 0-in. clear span and the load applied through a 3-in. flat surface at the center of the span.

Interchangeable Parts. Guard rail parts furnished under this specification shall be interchangeable with similar parts, regardless of the source or manufacturer.

Inspection. Guard rail parts shall be inspected to determine that the material dimensions and workmanship are in accordance with the standard drawing and this specification.

Installation. Posts shall be spaced on 12-ft 6-in. centers measured along the center line of the rail. The rail elements shall be lapped in the direction of traffic. When designated on the plans, the rail elements shall be curved before erection. Holes for special details may be field-drilled or punched, when approved by the engineer. Terminal sections shall be attached to the ends of each installation and shall be lapped on the face of the rail.

Painting. No painting of the aluminum guard rail elements, end sections or fasteners will be required.

ALCOA ALUMINUM

Your Guide to the Best in Aluminum Value

For Exciting Drama Watch "Alcoa Theatre," Alternate Mondays, NBC-TV, and "Alcoa Presents," Every Tuesday, ABC-TV

Aluminum Company of America, Dept. 1912-E
Alcoa Building, Pittsburgh 19, Pa.

Please rush complete details on Alcoa Aluminum Deep Beam Guard Rail!

Name_____

Firm_____

Address_____

City_____ Zone____ State_____

NEW NEW 3000-lb. CAPACITY CASE®

does the work of 2 smaller rigs for .....

speeds truck loading

8' dump clearance, with 37" reach, enables you to fill trucks fast. Note how tilt cylinders stay parallel with lift arms . . . no pinching or shearing action to endanger operator.

get a free demonstration . . . see how this NEW 1-cu. yd.

7600 lbs. of breakaway

Enables you to fill bucket quicker for faster load-and-dump cycles.

no bounce, no dip, no sway

Better weight distribution means greater safety, less spill loss.

attachments add versatility

Bucket interchanges with rotary broom, pallet fork. All-weather cab available.

W-5 TERRALOAD'R

..25% less cost!

Available on monthly
LEASE
— with or without down payment or trade-in.

Here, at last, is a *full cubic yard,* 1½-ton capacity, unit loader that will move as much material under normal conditions as *two* smaller wheel rigs. What's more, you *save up to $1500* in budget cost because major components — including engine and transmission — are engineered and built by *J. I. Case,* instead of being purchased from *"outside"* sources.

more good news!

With the Case-powered W-5 you get just the *right* combination of engine power and machine weight to insure maximum output, with *minimum fuel consumption.* Torque-converter drive doubles push-pull power instantly, automatically — *without clutching, shifting or stalling.* Forward-reverse power-shift, coupled with front-wheel drive and rear-wheel power-steer, provide exceptional maneuverability and ease of handling.

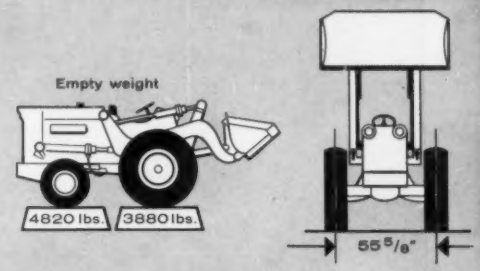
6 equipment options ... more coming!

The W-5 is available now with interchangeable 1-cu. yd. or 1½-cu. yd. (light material) bucket, pallet fork, block fork, rotary broom, and optional all-weather cab. Other add-on attachments coming soon. So don't delay. Mail handy coupon today for full details and a free W-5 demonstration on your job.

CASE®
J. I. CASE CO., RACINE, WIS.
World-wide sales and service

73% MORE CROWDING POWER gets heaped loads faster

You've never seen anything to match the fast, smooth crowding action of the Case W-5. *Parallel-circuit* control-valve applies full power from 30 gpm pump to *both* lift and bucket-tilt cylinders at the *same time.* In addition, tilt cylinders use *full* piston area on breakout stroke, to produce a total breakaway force of 7800 lbs. — *73% more than any competitive machine* in the W-5 price range.



Better machine balance helps you carry more, spill less

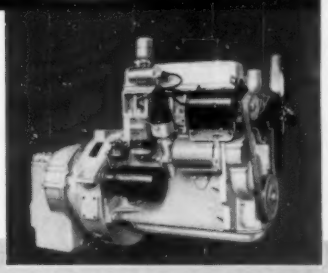
Exclusive Case design puts *24.2% more* empty machine weight on rear wheels, so you can carry heaped payloads faster, more safely, without tipping forward, or spilling load. Extra-wide wheel-tread, plus low center of gravity, gives unequalled lateral stability for dumping into high trucks, without "reeling" or side-sway.

MAIL THIS COUPON TODAY
for full details!

TERRALOAD'R can cut your costs

excellent maneuverability

Short 10'4" turn radius makes maneuvering easy in tight spots.



correct power-weight ratio

164-cu. in. Case engine provides dependable power, low fuel cost.

J. I. CASE CO., Dept. E1349,
RACINE, WIS.

☐ Send full information on the W-5 Terraload'r.

ALSO SEND LITERATURE ON:

☐ Larger 4-wheel-drive Terraload'r ☐ Backhoe-Loader on rubbe
☐ Crawler-mounted Backhoes ☐ Crawler-mounted Loader
☐ 100 HP Power-Tilting Bulldozer ☐ Power-Angling Doze

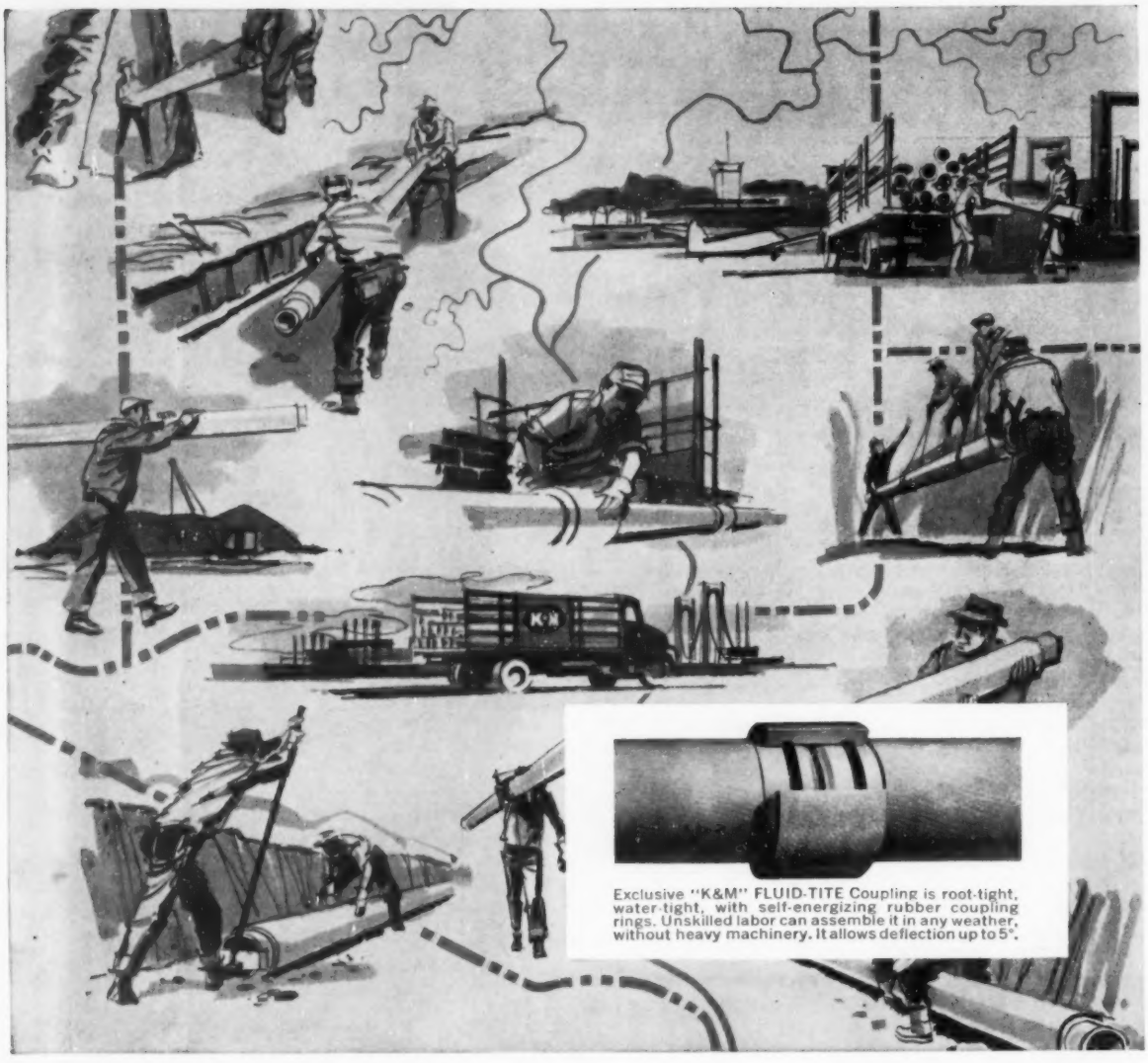
Name ..... Title .....

Company .....

Address .....

City ..... Zone .... State .....

C-TL-304



Exclusive "K&M" FLUID-TITE Coupling is root-tight, water-tight, with self-energizing rubber coupling rings. Unskilled labor can assemble it in any weather, without heavy machinery. It allows deflection up to 5°.

FROM KEY WEST TO L.A.

Modern communities are joining the trend to the modern pipe—

"K & M" ASBESTOS-CEMENT PRESSURE PIPE with FLUID-TITE COUPLING

• Permanent, root-tight, water-tight connections • Non-tuberculating • Non-electrolytic • Corrosion-resistant • Longer sections—fewer joints • Pumping costs remain low • Your low first cost is often your last cost.

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
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RUST-OLEUM®

STOPS RUST!®

and beautifies as it protects in many attractive

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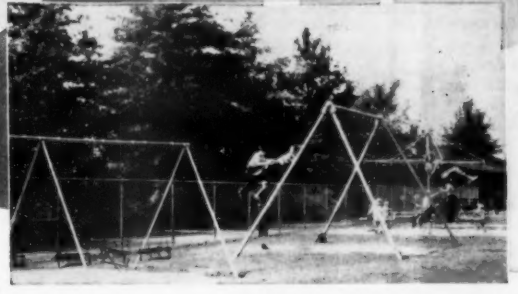

Why let rust mar your park and playground equipment? Rust-Oleum *Stops Rust!* – and beautifies swings, slides, merry-go-rounds, fences, receptacles, buildings, power equipment, etc. Easy to apply by brush or spray, and dries to a firm, decorative coating that resists sun, moisture, heat, fumes, rain, snow, and weathering! Your nearby Rust-Oleum distributor maintains complete Rust-Oleum stocks in all colors for prompt delivery. Clip coupon to your letterhead for complete information and FREE TEST SAMPLE of Rust-Oleum 769 Damp-Proof Red Primer, *today!*

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2680 Oakton Street — Evanston, Illinois

Gentlemen: Please send me a FREE TEST SAMPLE of Rust-Oleum 769 Damp-Proof Red Primer for application over sound rusted surfaces, and complete information on the following:

- ☐ New 36-page catalog showing Rust-Oleum colors and applications.
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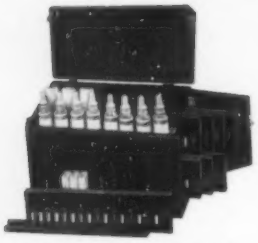
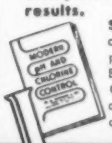


Model L-3 for pH, chlorine tests

Here are compact, portable test sets that give highly accurate determinations yet are so simple to use that tests can be made on-the-spot in only minutes. Data obtained simply by placing treated sample in center tube and moving color standard slide across until sample liquid matches one of the color standards. That's all there is to it. Read values directly from the slide, and you have accurate, dependable data for use in water or sewage plant operations. Model L consists of an Enslow Slide Chlorimeter and 3 or more pH slides, in a wooden carrying case. Also available — Taylor Comparators and Midget Testers for control of swimming pool water.

COLOR STANDARDS GUARANTEED
All Taylor liquid color standards carry an unlimited guarantee against fading. Be sure to use only Taylor reagents and accessories with Taylor Comparators to assure accurate results.



SEE YOUR DEALER for Taylor sets or immediate replacement of supplies. Write direct for FREE HANDBOOK, "Modern pH and Chlorine Control". Gives theory and application of pH control. Illustrates and describes full line.

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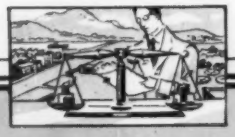


LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Woodsman Spare That Tree

Carstensen v. Clinton County, 94 N. W. (2d) 734, an Iowa case decided Feb. 10, 1959, was an action by a farmer to enjoin the county board supervisors from cutting down or injuring 16 large evergreen trees in front of his farmyard, along a federal-aid secondary road which was being widened and improved.

The trial court found that if the trees with their overhanging branches were to remain, the driver of a modern car entering from plaintiff's drive upon the thirty-foot highway when completed would be unable to view approaching traffic at a safe distance without driving his car to a position which would place the front bumper 2½ feet on the highway.

The trial court also found that if the trees were permitted to stand, the overhang of lower limbs would materially interfere with the operation of standard road equipment employed to construct and maintain the drainage ditch and gutter slopes.

Thus, the trial court refused the injunction.

On appeal, the Supreme Court of Iowa affirmed the trial court's holding.

Dam that Abandoned Watercourse

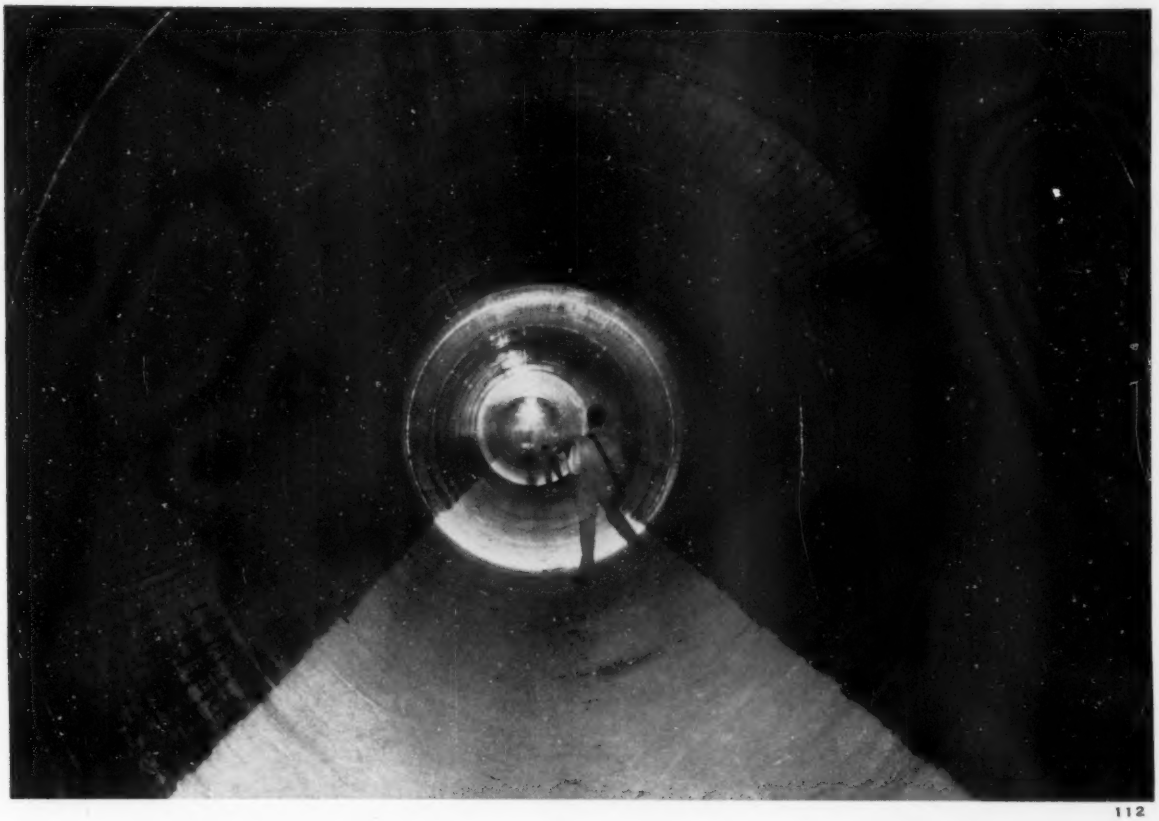
City of Stockton v. Miles & Sons, Inc., 165 F. Supp. 554, decided by the United States District Court in the Northern District of California on July 31, 1958, was an eminent domain case in which the city attempted to condemn certain real property owned by the defendant, for the purpose of constructing on it a public improvement in the nature of a flood control facility.

The principal issue related to whether or not part of the property to be condemned was an existing natural watercourse. The defendant claimed that it was an abandoned natural watercourse.

For many years prior to 1913, waters of the Calaveras River watershed had drained into the Calaveras River east of the City of Stockton, and had flowed through the Calaveras River to the San Joaquin River. About 1860 a channel or ditch, known as Mormon Slough, was dug, running from the Calaveras River to and through the City of Stockton, and ultimately into the San Joaquin River. This channel became the carrier of the major portion of the water of the Calaveras River watershed. In 1913 a project (consisting of a diverting canal and levee) was completed, which cut off the flow of water in the westerly portion of Mormon Slough, and from that time forward none of the natural flow of the Calaveras River watershed has entered the City of Stockton. Following that time, the portion of Mormon Slough passing through the City of Stockton has come to be known as Mormon Channel.

From some time prior to 1930, and until the end of 1955, the only water which reached Mormon Channel and passed through it to its outlet was certain local surface water—rain water, lawn waterings and the like—and intermittent flood waters from Duck Creek.

As far back as 1939, the City formulated tentative plans for filling in the Mormon Channel. These plans were given considerable local publicity. After 1951 the City's plans for filling Mormon Channel crystallized. The City Engineer made a thorough engineering study of the maximum amount of local surface waters which could be anticipated, and he designed, and the City installed, a conduit or box culvert sufficient to carry this flow. The City then took necessary steps to place earthen fills across the channel to replace bridges which formerly traversed the area.



112

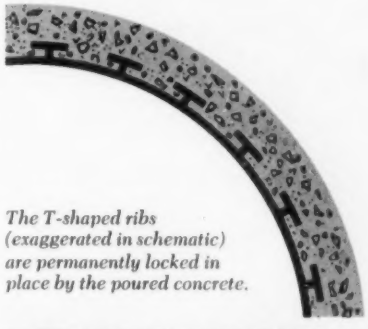
This Sewer will go a Long Way

Not only will this 9½-foot outfall sewer extend eight miles, but it will go a long way in years of trouble-free service. The engineers who designed it say that it will still be functioning perfectly in the year 2000.

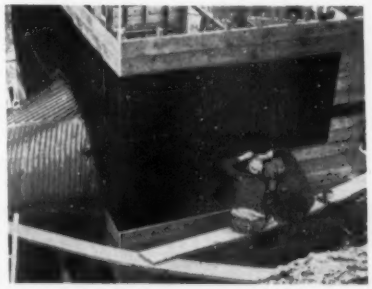
Their confidence is based on wise choice of construction materials. Every joint of pipe, every foot of monolithic tunnel, every structure is built of reinforced concrete to obtain structural strength at low cost. Every surface above the low flow line is completely covered by a continuous membrane of T-Lock Amer-Plate®, the vinyl lining that is impervious to the corrosive action of oxidized hydrogen sulfide *at any level of concentration.*

The engineers know that no one can accurately predict future rates of H_2S gas generation, so they have insured the ultimate life of the concrete by investing an extra 8 to 10% for T-Lock protection. They predict that this "extra" will spare their city the cost of a replacement sewer in about 20 years, and *save the taxpayers millions of dollars!*

Because of obvious and substantial savings such as this, millions of square feet of T-Lock are now in use in progressive municipalities from coast to coast. These include Los Angeles; Topeka; Wichita; Sioux **Falls; Shreveport;** Washington, D.C.; San Diego; Mansfield, Ohio; Huntington, W.Va.; Hutchinson, Kan.; and Orange County, Calif. T-Lock Amer-Plate is also on current specifications for many other municipalities. For complete list of users and specifiers, plus technical data and a typical specification, write:



The T-shaped ribs (exaggerated in schematic) are permanently locked in place by the poured concrete.



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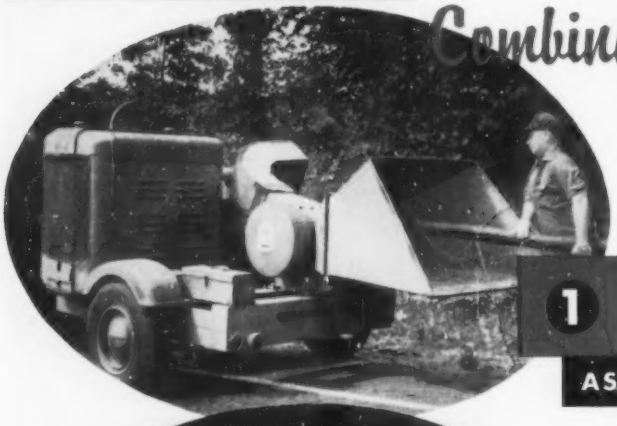

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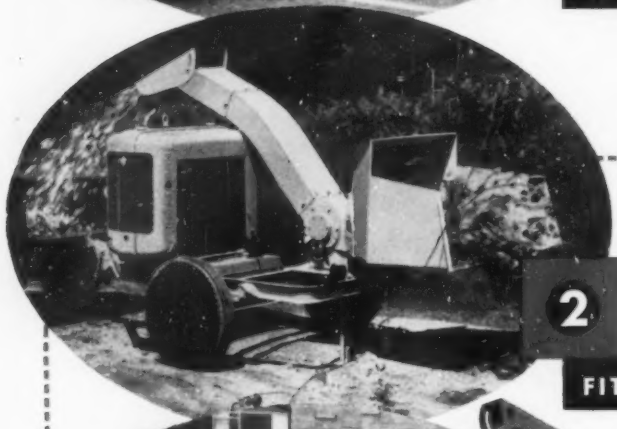

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Property owners along the channel began to place fill material in the channel with full knowledge and consent, and in some cases, at the request of the City. There is some indication that the City's street department crews and trucks actually helped fill in the property of the defendant.

By the end of 1955, a considerable portion of Mormon Channel had been filled in, and it was incapable of allowing water to pass, except for the conduit or culvert previously installed by the City.

However, on Dec. 23, 1955, an unprecedented flow of water in Mormon Slough resulted in the overflow of that watercourse. In addition, Duck Creek overflowed, and the flood waters worked their way into the Mormon Channel, within the city limits. All of the fills previously made were opened that night to allow the water to pass, except the filled area on defendant's land and on adjacent fill area. The water coursed over the banks of Mormon Channel, through defendant's shops and offices. Some of it eventually flooded the City. Meanwhile, the conduit or culvert was carrying its full capacity of water.

On the day following, the City entered defendant's land and opened a new channel across it. Shortly afterward, it commenced the present action to condemn the necessary land.

The court held that the City had, even prior to the filling of defendant's land, abandoned any rights to keep the channel open (aside from its closed culvert), and that the defendant was legally entitled to put its land to productive use by filling it in the manner in which it was filled. The fact that there was no formal ordinance or resolution by the City to effect such abandonment was held to be irrelevant. There were plently of official actions by the City, e. g. appropriating the funds for and filling the channel at several places, and constructing the culvert.

Thus, while the City can condemn this property, it must do so under its eminent domain power, rather than under its police power. In other words, it must pay for it.

• • •

Power Generation

Eight of the sewage treatment plants in New York City are provided with power generating facilities. During 1958, a total of 37 engines served as sources of power, of which 15 use gas and 22 are of dual-fuel type. The combined capacity rating of all 37 engines is 35,000 hp.

"I bought another Sherman Digger because . . .

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Write for Bulletin No. 590

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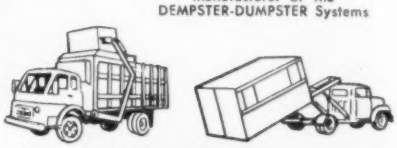
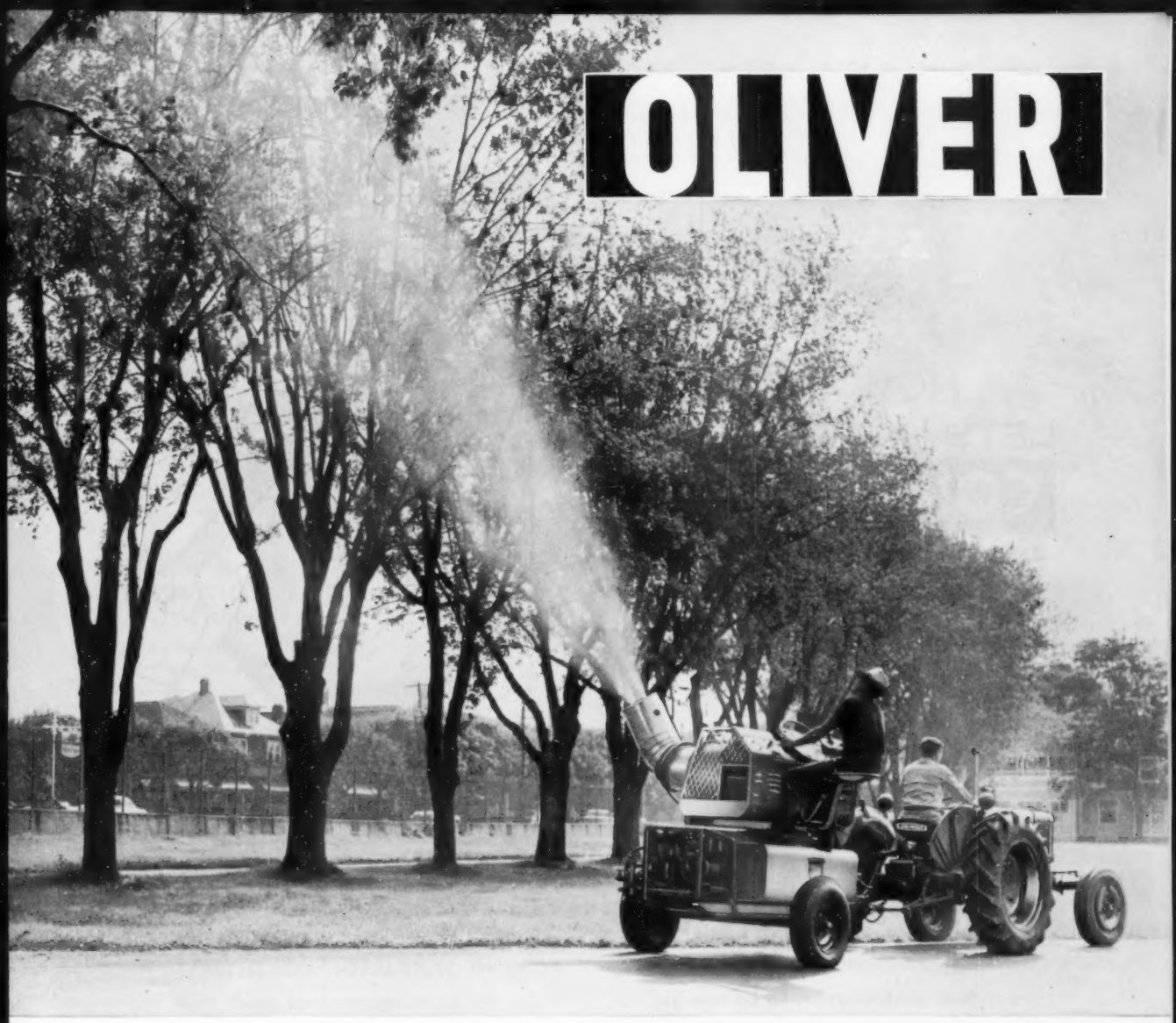


Dept. PW-5 DEMPSTER BROTHERS Knoxville 17, Tennessee



CONTROL ELM DISEASES WITH OLIVER'S SPRAYING METHOD

The Oliver method of mist spraying is a most effective and economical way of controlling Dutch elm and other diseases, elm leaf hoppers and elm leaf beetles. Oliver spraying units, such as the Model 125 mist sprayer shown above, provide effective control with microscopic droplets that cover exposed surfaces. Only one to three gallons of spray solution is required per large-size tree.

Oliver mist spraying also provides high-coverage protection against mosquitoes, flies and other insects. The spray reaches into remote corners...leaves a residue that protects for a long period.

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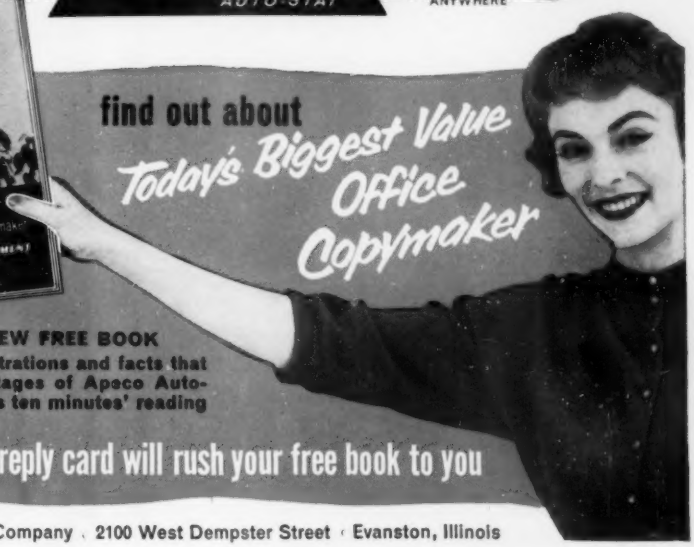

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One of the unusual and exclusive attachments available for "PAYLOADER" tractor-shovels that doubles their utility and value for water and sewer departments is the Hough-Superior Side Boom. This attachment does not interfere with the bucket operations . . . permits alternate bucket and boom use without loss of time. With the boom, you can load, unload, carry and spot pipe and lower it into the trench . . . can walk over curbs and sidewalks.

Hough Wain-Roy Back Hoes are available for rear-mounting on rear-wheel drive "PAYLOADER" models — for front-mounting on 4-wheel-drive models. On the latter, they interchange with the bucket in minutes. These hoes can dig and dump at any angle up to 95° right or left — a valuable feature in close quarters and heavy traffic areas. They will dig 12-feet deep to trench, dig bell holes, install service connections — also load and unload pipe and fittings and lower them into the trench.

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Public Park Boards

Two valuable and useful attachments for park maintenance that are available only on "PAYLOADER" units in the rubber-tire tractor-shovel field are the Drott 4-in-1 Bucket and the Ram Black-top Spreader. With the 4-in-1 bucket, a "PAYLOADER" unit handles many jobs other wheeled tractor-shovels can't touch — combines the usefulness of a shovel, clam-shell, scraper and bulldozer.

The Ram Black-top Spreader is a self-powered attachment with 2 cu. yd. hopper that lays up to 8-ft. widths of hot or cold mix — from 0 to 6″ thick. Sliding gates are adjustable for laying widths up to 4-ft. Use it to pave streets, playing and parking areas — to patch pavement after trenching.

To all this on-the-job usefulness a "PAYLOADER" tractor-shovel adds the equally valuable element of *mobility* to travel at city traffic speeds and handle several scattered jobs in a single day.

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PAYLOADER® Versatility

Road—Street Departments

An extra-bonus attachment for street and road departments is the Vibratory Compactor — a self-powered, self-contained unit, interchangeable with the "PAYLOADER" bucket. It uses the proven Jackson system of engine-generator and electric vibratory units... has 4 pads that cover a width of 10-feet and develops specified densities in all granular soils.

The Ram Leaf Loader is another exclusive "PAYLOADER" attachment and is available for both 2-wheel-drive and 4-wheel-drive models. One city reports that it picks up 90% of the bulk and saves 30% of leaf loading costs. Individual hydraulic motors power the pick-up reel and each of the three conveyor belts. This leaf-loader also has secondary use for snow removal in fringe snow areas. A "PAYLOADER" tractor-shovel can pay its way all year long, whether your city is located in the South or in areas with severe winters.

Sanitation Departments

The Sanitary land-fill method of garbage disposal is another "PAYLOADER" tractor-shovel application that has proven successful with both large and small cities — on both a part-time and a full-time basis. Utilizing the Drott 4-in-1 Bucket, the "PAYLOADER" can do the entire job — excavate the trenches... spread and compact the garbage... strip, carry and spread the earth cover and compact it.

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Many other attachments beside those shown on these pages help make "PAYLOADER" units popular with public works bodies — pick-up street sweeper, snow plows (rotary, V, one-way and reversible types), back-filler blade, fork-lift, crane hook.

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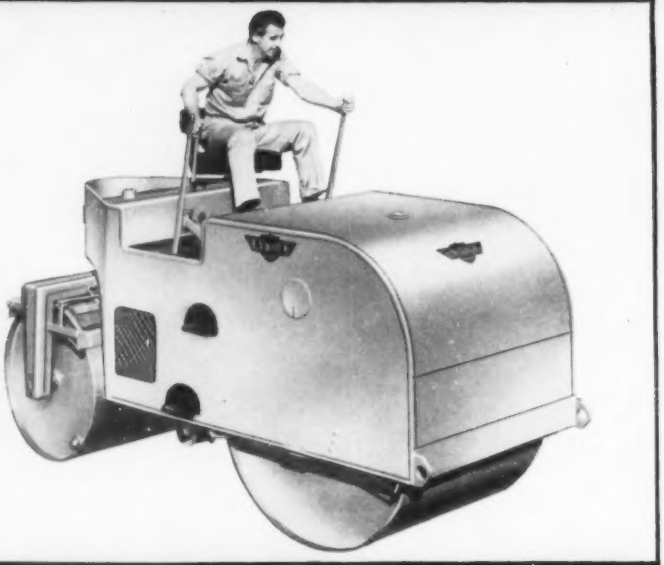
TANDEM ROLLERS

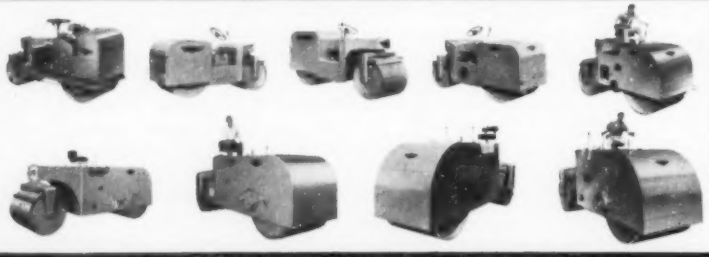


Model 560 -3 1/2 to 5 1/2 Ton Roller

There's a
BIG DIFFERENCE
over a million miles of proof!

Essick Rollers, engineered and designed to offer a completely integrated line of 14 models, from 1/2 ton to 14 tons, are saving contractors thousands of dollars by providing more compaction at less cost—for any size job.

Contractors that use them....recommend them!
See for yourself—ask for a demonstration



14 models of Tandem Rollers—from ½ ton to 14 tons

ESSICK MANUFACTURING COMPANY

1950 Santa Fe Avenue
Los Angeles 21, California

850 Woodruff Lane
Elizabeth, New Jersey

Affiliated with THE T. L. SMITH CO., Milwaukee, Wisconsin

LETTERS TO THE EDITOR

COEFFICIENTS FOR THE SOLUTION OF MANNING'S FORMULA

An article appeared in PUBLIC WORKS for March, 1959, pages 112-113, in which the author presents Table 1—Flow in Circular Pipes, consisting of a set of coefficients "which have proven very convenient in the design of circular sewers . . . designed for use with a slide rule or calculating machine."

In reviewing the article it is found that in working with the coefficients ranging from three to nine decimal places there is a definite chance for making an error in a decimal place in the final answer.

Secondly, the author has evidently overlooked the fact that there now is available a "Sewer Design Slide Rule" for solving directly and swiftly sewer design problems for full-flow and part-full flow in much less time than it would take with the set of coefficients.

Thirdly, how would he design for part-full flow with his coefficients?

It is surprising to note that he mentions nomographs and tables but not the Sewer Design Slide Rule which is very accurate and a time saver in any sewer design office.

Irving Goldfien
Sewer Research Engineer
City Hall
Milwaukee, Wisc.

I appreciate the opportunity extended to me by PUBLIC WORKS Magazine in order that I may reply to comments in Mr. Goldfien's letter of March 18, 1959 regarding my article "Coefficients for the Solution of Manning's Formula" published in the March issue of PUBLIC WORKS.

First, I was not aware that engineers were to confine their computation to decimal places less than three in number in order to eliminate the possibility of errors.

Secondly, I have used and have seen many types of hydraulic slide rules in existence today such as: The Tarrant Hydraulic Slide Rule

Where to use Butterfly Valves

The field of use for rubber seat butterfly valves is broad, comprising the handling of large volumes of liquid or gas at pressures up to 125 psi. and at temperatures from —20°F to 190°F. Within this area, inherent simplicity of form and function in the butterfly valve give it great advantages over other types of valves.

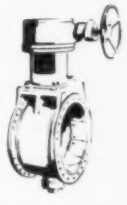
Henry Pratt butterfly valves are light in weight, compact and mechanically simple, factors that greatly reduce the kind of installation and maintenance costs that can be shockingly expensive in valves weighing a ton or more.

As you can see below, the great advantages inherent in butterfly valves have been multiplied, through Henry Pratt engineering, into a wide variety of practical, economical valving for standard operations as well as unusual problems in power and water works systems.

LOW PRESSURE valves are widely used in water works, power stations and industry where pressures range from vacuum to 50 psi. Pratt has built valves as large as 14 feet in diameter for wind tunnel use, and, for air circulation in nuclear power plants, valves that slam shut in 3/10 of a second.

COMBINATION VALVE AND EXPANSION JOINT combines two functions in one unit. This is economical both in material and installation costs because it eliminates one set of flanges and bolts. Units are built with rubber or steel bellows expansion joints.

HIGH PRESSURE valves are excellent for pump discharge-check applications and water distribution service. These valves have an upper pressure limit of 125 psi and velocity capability as high as 55 feet per second.

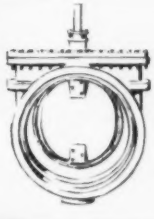


SPECIAL END VALVING. In some installations, such as water main service, flanged connections are not necessary, so both High and Low Pressure Pratt Valves are built with end modifications for bell-and-spigot piping and couplings such as Dresser or Victaulic.

ENDS OF PIPELINES or conduits. Single flange valves can be bolted directly to the end of a pipeline, conduit, settling basin wall or face of a reservoir. Functioning as sluice gates, they have the added advantages of permanent drop-tight shut-off with no need for adjustment or maintenance.

EXTRA LENGTH VALVING. Butterfly valves are often used for economical replacement of other valve types. As Pratt valves are relatively narrow, the laying length is increased by using a wider valve body or adding a spool piece.

LIMITED SPACE. Developed by the Henry Pratt Company, the Ob-Round valve makes it possible to obtain a desired valve area where space limitations prevent the use of a round valve. Ideal for basin or conduit applications.



INSERT VALVING. An original Pratt development that simplifies the replacement of gate valves by butterfly valves. The entire butterfly valve fits inside the gate valve body, saving the cost of removing valve body from the line.

If you would like to know all about Henry Pratt valves, write for our Manual of Rubber Seat Butterfly Valves B-2T

HENRY PRATT — RUBBER SEAT Butterfly Valves

HENRY PRATT COMPANY, 2222 S. HALSTED ST., CHICAGO 8, ILL. • REPRESENTATIVES IN PRINCIPAL CITIES

Just off the press- All about the Thoro System Products

You will want this for your reference file. A complete and concise 20 page brochure, showing treatment and correction for masonry construction.

Know these and many other products in our New Brochure. They are the answer to your maintenance problems.

Standard Dry Wall Products Inc.
NEW EAGLE, PA. CENTERVILLE, IND.

distributed by The Paterson Engineering Company Limited of London, England; The Hazen-Williams Hydraulic Slide Rule manufactured by Dennert & Pape of Hamburg, Germany; and of course The Sewer Design Slide Rule by Irving Goldfien, C. E., of Milwaukee, Wisconsin. However, I still find my coefficients give excellent results and do not require a complicated set of instructions to arrive at an answer.

In answer to his third question it was assumed that the individual making use of the coefficients in my article had a basic knowledge of sewer design and that he could obtain a sewer elements chart and resolve any problem on sewers flowing partly full.

In closing, I wish to point out that the publishing of my article was not intended to eliminate purchase of proprietary items in the engineering design field.

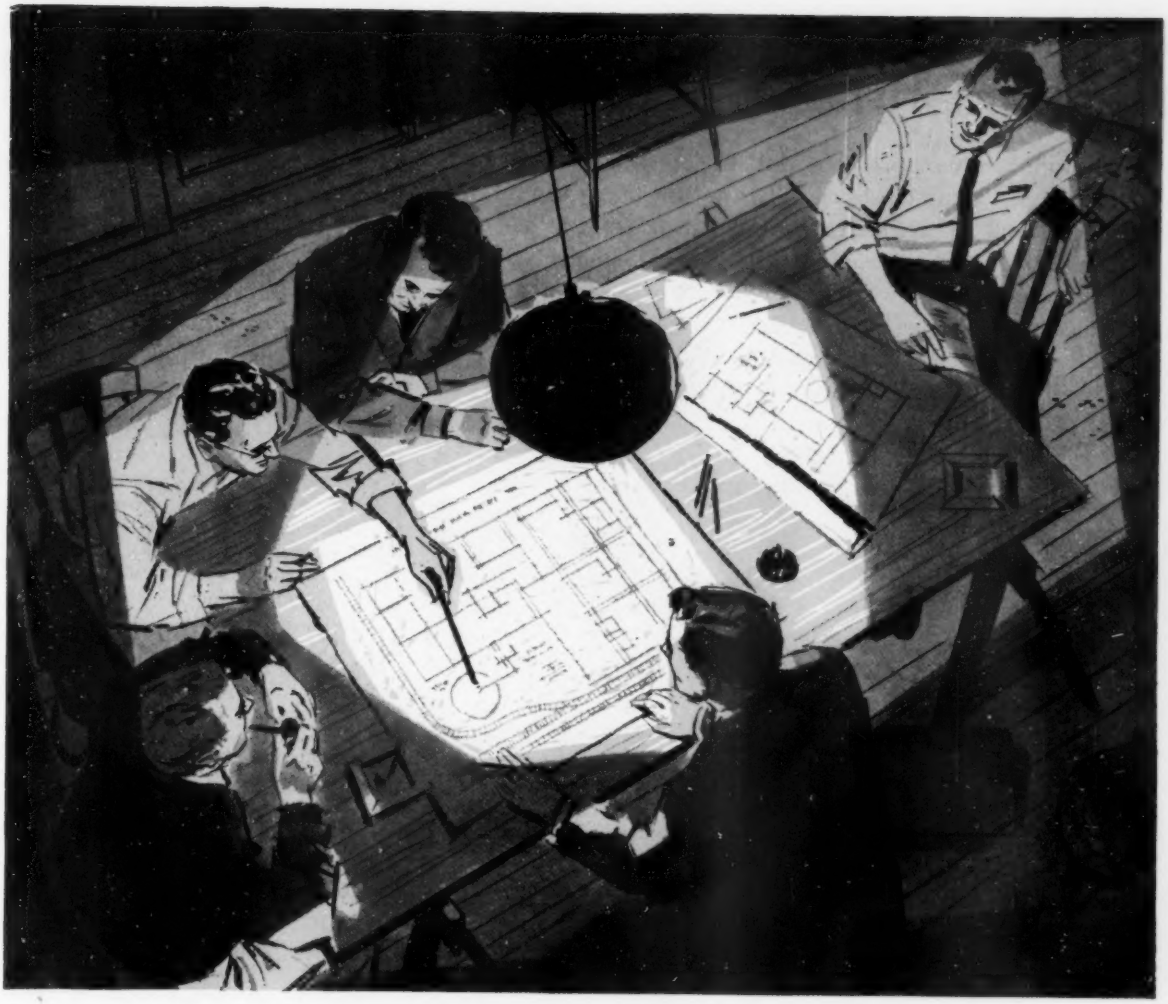
Theodore Kapoustine
Buck, Seifert and Jost
Consulting Engineers
New York, N. Y.

SAFETY DEVICES ON GARDEN STATE PARKWAY

The article entitled "Safety Devices on the Garden State Parkway" appearing in the February, 1959 issue of PUBLIC WORKS Magazine has aroused considerable interest here in Hendersonville. Perhaps being a native son of New Jersey makes me a bit proud of the Garden State Parkway and its many fine safety features.

One of the reasons why the safety record of the Garden State Parkway is so outstanding is the fact the lighting was applied at the numerous critical areas of driver decision, such as entrance and exits, access roads, toll plazas and service areas. This is particularly true in the restaurant and service areas which are located

● LIGHT standards on the Parkway.



We can give you valuable help

In designing, installing or converting water softening equipment

There's no charge for the services of one of Morton's Consulting Engineers at any stage of your work with water softening systems. Many architects and engineers have already found that calling in a Morton man can save time and work and will result in water softening installations that provide maximum efficiency and the greatest economy of operation.

The Morton Consulting Engineers have experience with all types of water softening systems for all types of uses. The assistance they offer is well worth an inquiry. If you think a Morton Consulting Engineer could be of assistance to you, just send in the coupon today.

I would like to know how a Morton Consulting Engineer could help me_____

I understand there is no charge for this service.

Name_____

Title_____

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City_____ Zone____ State_____

MORTON SALT COMPANY

INDUSTRIAL DIVISION

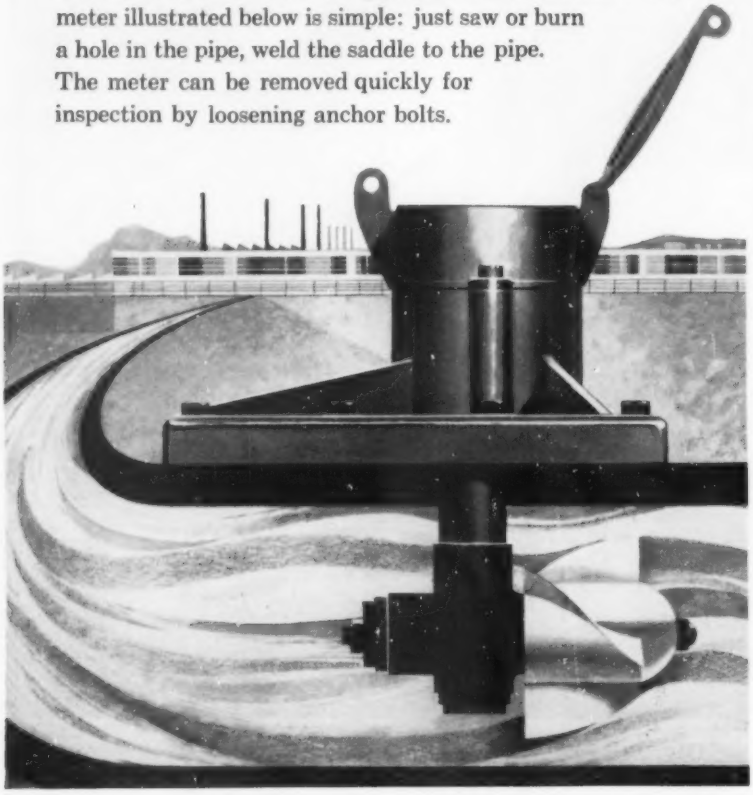
Dept. PW-5, 110 No. Wacker Drive, Chicago 6, Illinois

Increase efficiency and water profits with

MEASURE-RITE propeller meters

Measure-Rite meters can be installed on new or existing lines . . . for accurate, dependable water metering control.

They will register accurately whether mounted in horizontal, vertical or *inclined* positions. Installation of the meter illustrated below is simple: just saw or burn a hole in the pipe, weld the saddle to the pipe. The meter can be removed quickly for inspection by loosening anchor bolts.



Free flow design
assures low loss of head

In the Measure-Rite assembly, the propeller is positioned *forward*, fully centered in the metering chamber for greater metering accuracy. Free flow design provides least restriction of flow — minimizing loss of head.

Send for Bulletin MR-105 describing the complete line of Measure-Rite propeller meters. Address inquiries to:

MEASURE RITE, INCORPORATED

A Subsidiary of BADGER METER MFG. CO.
4545 W. BROWN DEER RD. • MILWAUKEE 18, WISC.

in the median. According to the preferred highway design procedures today, left-hand exit and access roads are frowned upon due to considerable adverse experience with this type of construction. The application of highway lighting on the Garden State Parkway undoubtedly helps facilitate the movement of traffic and provides the motorist with visibility he would otherwise be deprived of at night if the lighting had not been installed.

Experiences in Indiana and on such facilities as the Edens Expressway in Illinois show a 40 percent reduction in accidents after lighting has been installed, despite the fact that the daytime accident rate has generally climbed higher. Without a doubt, the safety record of the Garden State Parkway would be nowhere near as good as it is today if authorities had failed to install lighting initially.

The Garden State Parkway rightfully prides itself in its safety record as well as its roadside development. It is surprising that its lighting installations were omitted from your article on safety devices.

W. E. Schwanhausser
Manager—Application Engineer
General Electric Co.
Hendersonville, N. C.

SEWER PIPE BRIDGE

I was particularly interested in the article, "Single Beam Construction Carries Sewer Pipe Across Stream," by Ralph Crossman which appeared in the July, 1958 issue of Public Works.

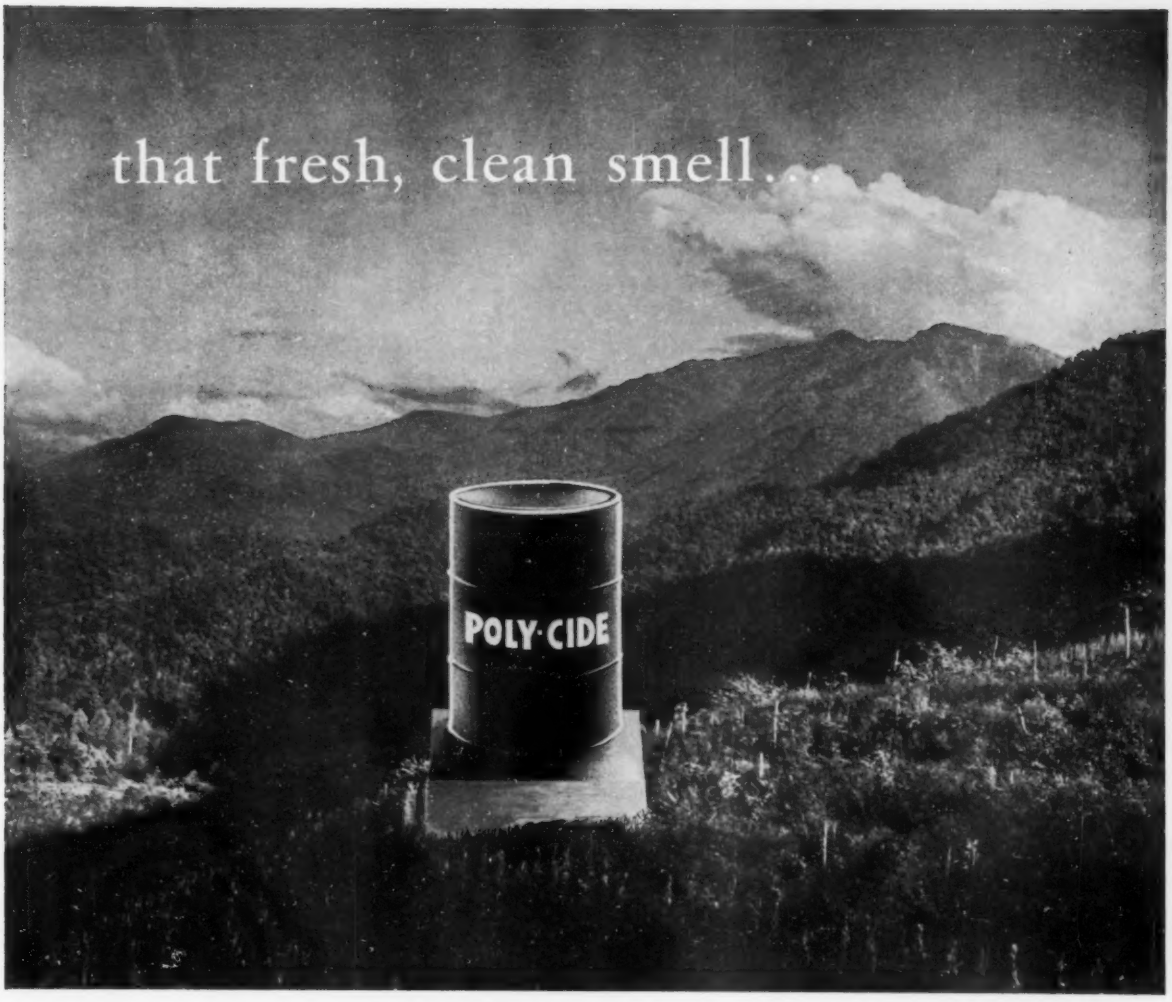
After a hurricane we were confronted with a similar problem at the Monson State Hospital. Bridges, steam mains, sewers, river bed, manholes and parts of buildings outside the river had been washed out.

We had to run a sewer from a new infirmary building across this river. There was plenty of evidence of what it had done to piers. We recommended a method similar to the one described in the Article which was finally accepted and constructed. So you can understand why I would appreciate some of the extra copies.

Stewart Sherburne,
Woburn, Mass.

Sewage Treatment and Pumping In Seattle

There are six sewage treatment plants and 52 sewage pumping stations serving and operated by Seattle, Wash.



Brooks Chemicals through scientific research have produced POLY-CIDE, a name which includes a variety of laboratory and field developed formulations designed to provide definite odor control of any degree desired, quickly, economically and satisfactorily.

POLY-CIDE Odor Control Treatments have been successfully used by municipalities in eliminating obnoxious odors from Sewage Plants, Stock Pens and Barns, Storm Sewers, Garbage and Rubbish Trucks, Refuse Cans and Public Rest Rooms.

No complex feeder, storage space or man-power is needed in the application of Brooks POLY-CIDE. It is the most convenient, effective and inexpensive odor control method today. Write us about your specific odor problems.

BROOKS *Chemicals, Incorporated*

PLANTS

3304 E. 87th St., Cleveland 27, Ohio ★ 461 Cumberland Ave., Hamilton, Ontario

Offices In Principal Industrial Cities

SINCE 1876

engine power
BY CATERPILLAR

Cat Engines solve Hartford's flood problem

Flood control makes possible new industrial area

It wasn't so much the river as the land that was causing trouble in North and South Meadows—the lowest sections of land around Hartford, Connecticut.

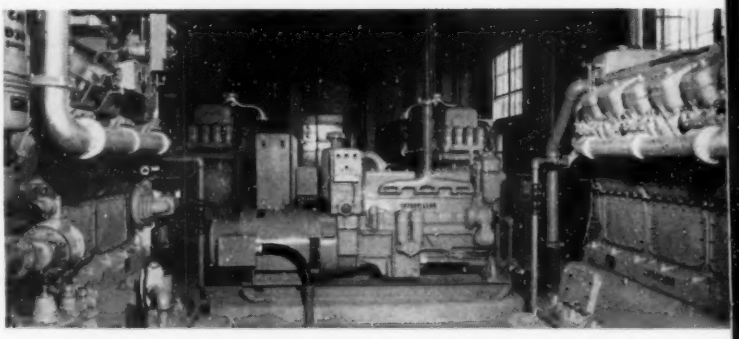
Five miles of dikes restrained the Connecticut River. They offered protection against a river depth up to 45 feet. But this didn't keep the Meadows dry. Excess water falling within the Hartford area drained into these two areas. And the existing pumping stations couldn't handle all the water—they had a total capacity of only 108,000 gallons per minute. They needed to move a minimum of 216,000 gpm.

The situation was serious not only because it involved lives and property, but because Hartford wanted to develop North and South Meadows as Industrial Park Zones in order to bring new industry into the area.

The Caterpillar Dealer Engine Specialist worked closely with the city to solve the problem—with the help of Cat Diesel Engines. By installing 10 Cat D397 Diesels to drive the existing pumps at higher speeds, Hartford was able to boost pumping capacity to 375,000 gpm, which gives them a comfortable factor of safety.

Wherever *you* need a supply of power—mechanical or electrical—that you can count on day in and day out, in any emergency, select a Cat Diesel or Cat Electric Set. They are easy to operate, require very little maintenance, are simple and sturdy in design. Write for more details and free literature. Or call in the local Caterpillar Dealer Engine Specialist.

THE CITY IS SAFE behind solid dikes that keep the Connecticut River in its place. But excess runoff behind the dikes must be pumped out of the lowest areas and into the river. Pumping has to start when the river reaches 8 feet. Dependable Caterpillar diesel power handles the job and keeps industry dry.



10 WORK LIKE 21. 10 powerful Caterpillar Diesels, like these (engines to left and right in photo), pump over 3 times as much water as 7 engines previously used on the same pumps. They solve Hartford's problem of keeping a new industrial area free from flooding. Dependable Caterpillar Engine Power (center engine) is used to provide standby electric power, too, to operate air compressors, floodgates, lights, heating and other services.

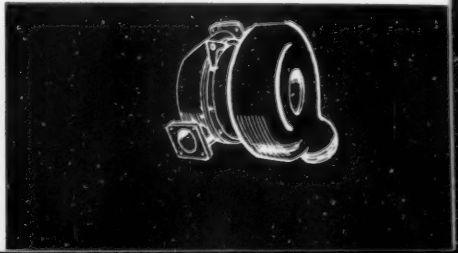
Engine Division, Caterpillar Tractor Co., Peoria, Ill., U. S. A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

KNOW HOW. Your Caterpillar Dealer Engine Specialist will help you select the right equipment and help you with installation.

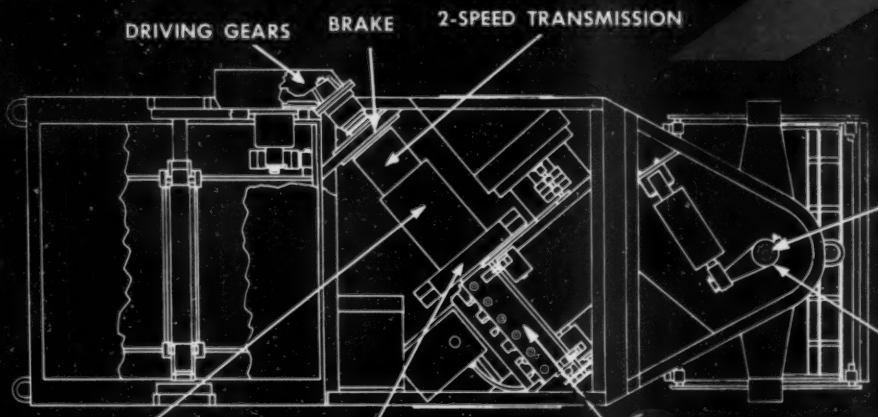
LOW FUEL COST. Caterpillar Engines don't require expensive diesel fuels, work fine even with No. 2 furnace oil. They burn fuel more completely, to save you money.

MORE POWER. Turbocharging, available on most Cat Engines, gives you more horsepower per pound of weight . . . improves engine efficiency.

CDES

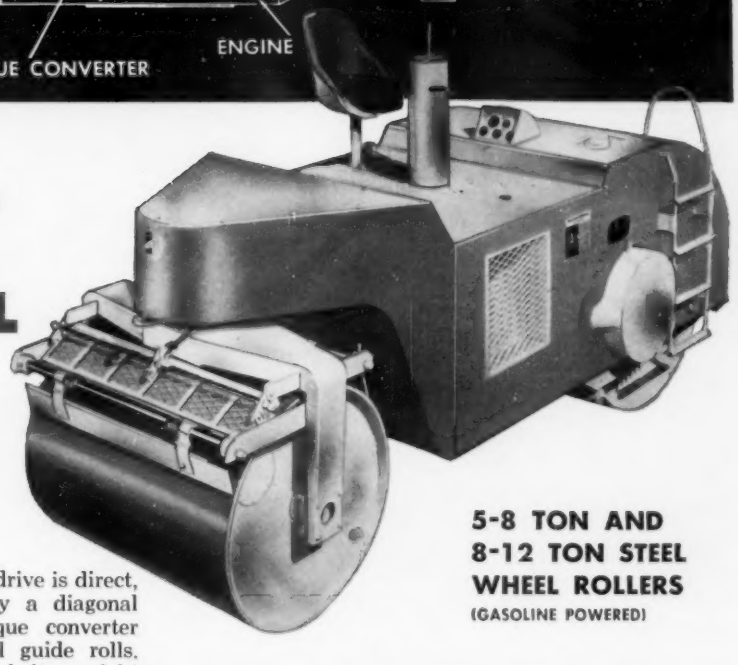


NEW DIRECT-IN-LINE DRIVE GIVES YOU FULL POWER...



in these

SEAMAN-ANDWALL STĀ-BILT STEEL WHEEL ROLLERS



The roller built with the maintenance man in mind . . .

The power-train from engine to roll drive is direct, an engineering feature attained by a diagonal mounting of the engine and torque converter transmission between the drive and guide rolls. No power-robbing chains, jackshafts, belts or right angle drives.

Another exclusive feature: heavy KING PIN is not only splined but is also clamped securely to the steering sector of the guide roll to completely eliminate side movement of the roller.

5-8 TON AND 8-12 TON STEEL WHEEL ROLLERS
(GASOLINE POWERED)

Four large access doors to the engine and control compartments as well as a drive roll door make access quick and easy.

Let us tell you more about the STĀ-BILT Rollers — the most modern in service today.

SEAMAN-ANDWALL CORPORATION
A Subsidiary of American-Marietta Company
ELM GROVE 9, WISCONSIN

7074

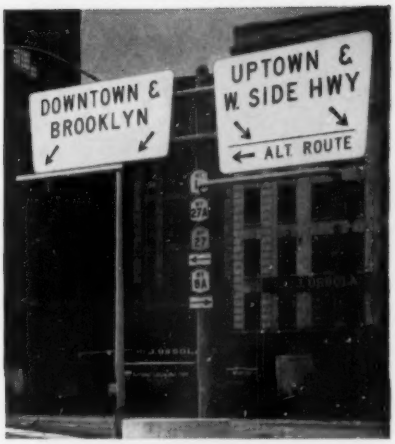
Overlaid plywood signs Port of New York Authority

GUIDING TRAFFIC to and through the busy airports, tunnels, bridges and highway approaches that comprise The Port of New York Authority facilities are modern color-coded overlaid plywood signs of every size and type—regulatory and directional . . . illuminated and non-illuminated . . . overhead, cantilevered and shoulder mounted.

Port of New York Authority traffic engineers make extensive use of overlaid plywood signs for two important reasons: first, they are less expensive (by one-third or more) than metal; second, they stand up better under deliberate or accidental abuse.

Plywood's strength and stiffness simplify framing. Installation is fast. It cannot rust or corrode, and the durable plastic-like overlay prevents checking and provides an ideal base for paint or reflectorizing.

direct traffic at facilities



Illuminated for nighttime legibility, Port of New York Authority sign installations are located in downtown manufacturing and commercial centers as well as semi-rural areas.

Two types of overlaid plywood sign panels are *high density* which needs no paint protection and permits direct application of reflective sheeting; *medium density* for plain painted signs. Base panel is waterproof Exterior (EXT-DFPA®) plywood.

Build a real future for your water department with the new

BADGER

Read-o-Matic*

REGISTER

a REVOLUTIONARY product.... for a totally new method of reading

Now your water department can look to a future of increased efficiency and economy — through the Badger Read-o-Matic, industry's first *practical* outdoor register..

With this revolutionary new outdoor register, you'll play a major role in community progress . . . by providing consistently better water department operation and service to *every* customer . . . starting with these *immediate* benefits:

BOOSTS WATER DEPARTMENT NET REVENUE

Eliminated: meterman recalls, "read-it-yourself" cards, estimated water bills. Result: reduced reading costs . . . and greater savings because of simplified department accounting and operation.

100% METER READING IN HALF THE TIME — AND NO WASTED CALLS

The Badger Read-o-Matic overcomes the chief problem of indoor reading: depending on the customer to be home. Instead, a meterman can complete his reading route in half the time it used to take by the old method — because the register is **outdoors** and always available.

BETTER SERVICE AND CUSTOMER GOOD WILL

Because the Badger Read-o-Matic is accessible to the meterman at all times, the customer will never be inconvenienced again. Your meter records are always up to date; the customer's meter bills will always be accurate.

*Patents applied for in U. S. A. and foreign countries.

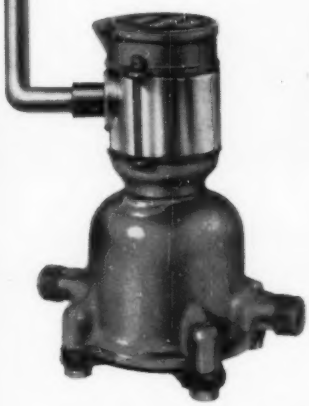
Dynamic New Idea!

Central reading stations

Glamorous *Mayfair,* Milwaukee, marks a new trend in ultra-modern suburban shopping centers. Its *metering system* — trend-setting,too.

A network of Badger Read-o-Matic registers serves Mayfair's more than 85 stores. Meters are located in the stores . . . connected to a central Read-o-Matic reading station for each section as shown in color on the aerial view (right). A typical panel of Read-o-Matic registers at Mayfair is shown below.

Meter reading — just a few minutes' work. And the Read-o-Matic registers are always accessible.



. . . Another in Badger Meter's big parade of new products for better water metering

Key to the Badger Read-o-Matic register — a self-powered generator that requires no outside source of power. It originates its own pulses that are recorded on the outdoor register. The register can be placed as far as one-half mile from the meter itself.

This revolutionary meter-register is another product of Badger's research devoted *exclusively* to the continuous improvement of water meter design, construction and performance.

Write us today. We'll send a free, colorful brochure with full details about the new Badger Read-o-Matic outdoor register.

Badger Water Meters

Badger Meter Mfg. Co. • 4545 W. Brown Deer Rd. • Milwaukee 18, Wis.

OFFICES IN PRINCIPAL CITIES

CONTRACTORS SAY:

"Lower installed costs"

Write for free Transite Pipe data kit. It contains complete information on how Transite benefits the water system designer . . . installer . . . and operator. Address Johns-Manville, Box 14PW, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

JOHNS-MANVILLE

ENGINEERS SAY:

"Pumping efficiency"

MUNICIPAL OFFICIALS SAY:

"Reduces water costs"

FROM DESIGN THROUGH OPERATION—

Transite Pipe never stops saving you money

Read what leading water system designers, installers and municipal officials say about many economies of Johns-Manville Transite Pipe

MAYOR *Walter Reynolds, Providence, R. I. says—*
"An efficient water system ranks high among the many advantages Providence offers industry. Since 1935, Transite Pipe has ably served in the continuing job of keeping our water system more than capable of meeting future needs. In this way our water system contributes not only to the health and convenience of our citizens, but also to the encouragement of industrial and economic growth in our city."

ENGINEER *Philip J. Holten, Jr., Chief Engineer Water Supply Board, Providence, R. I. says—*
"Transite's installation savings have helped us absorb recent increases in labor and material costs . . . Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can layTransite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

CONTRACTOR *C. J. Fanning, Pres. Fanning & Doorley Construction Co., Providence, R. I. says—*
"You soon see why Transite Pressure Pipe saves time and labor when you're working through old, unmarked utility and service lines. These unforeseen obstacles can cause costly slowdowns, but they present fewer problems with Transite. Its flexibility, easy handling and speed of assembly enable our men to work fast even under the most difficult working conditions. And by the same token—your crews really move along when conditions are favorable."

CONTRACTOR *Frederick J. Gallagher, F. J. Gallagher Trenching Co., Tucson, Arizona says—*
"By using Transite Pressure Pipe, we completed this 70,000-ft. water system contract several weeks faster than we had estimated. Transite's ease of assembly keeps our time and labor costs low. We excavate, install the pipe, and button up the trench fast. This speed is especially advantageous when we encounter cross service lines or are faced with bad weather. And always important, it means less annoyance to our own townspeople and the local merchants."

MAYOR *James L. Gardner, Wichita, Kansas says—*
"Every year—we actively go after new business . . . seek new firms to locate in Wichita to create job and business opportunities for our citizens. These new firms need water—and never fail to ask about our water system . . . which is one of the most efficient systems anywhere in the world. Part of its efficiency is made possible by Johns-Manville Transite Pipe which we have been using for many years."

ENGINEER *Leigh O. Gardner, Yost and Gardner, Engineers, Phoenix, Arizona says—*
"Transite has many advantages contributing to its economy. Its light weight, handleability and easy-to-join Ring-Tite Coupling keep our clients' final costs low. We find a continuing economy of operation throughout its long life. We have excavated lengths of Transite after 20 years of service and have found no sign of tuberculation . . . the smooth inside walls proving it still has low coefficient of friction and therefore highest carrying capacity."

Cloroben

proves most effective in grease and odor control in sewers!

As reported in recent issue of Public Works Magazine

ARTICLE by Levi Price, Township Engineer, and Harold Curran, Supervisor of Public Works, Millburn Township, N. J. proves that the more difficult your sewage odor or treatment problems the more startling and definite the proof . . .

"CLOROBEN IS AT LEAST TWICE AS EFFECTIVE AS OTHER PRODUCTS"

Well worth your attention is the complete Millburn history, typical of the reports sent us by professional sanitary engineers and sewage treatment plant operators.

Located along the Watchung Hills in Union County, Millburn is a fine suburban community. When vile sewage odors began to permeate the area in 1953, the residents demanded relief. During the summer of 1954 Cloroben was first introduced into the sewage collection system, and immediately stopped odor complaints. The Cloroben treatment was continued through 1954 and 1955 with excellent results. All odors were effectively controlled in lift stations, force mains and low gradient sewer lines.

Then, in 1956, various emulsifiable chlorinated benzenes were offered the township. Advertising claims indicated these products were almost identical to Cloroben. In price they compared favorably. So, in 1956 competitive bids were required, specifying Cloroben or equal. And, the contract was awarded to the lowest bidder.

Right after the change from Cloroben to the cheaper substitute, odor complaints began coming in. The amount of the chlorinated benzene used was doubled, then quadrupled. Everything else possible was done. Low gradient lines were flushed periodically, and lift station wet-wells cleaned weekly. But, the odor complaints persisted and increased. Sulphides and pH determinations were made throughout the system. Odorous areas invariably showed sulphides at 0.3 ppm or more. The situation got even worse right up to July 31, 1957, when use of the cheap chlorobenzene substitute was stopped. On the following day Cloroben was reinstated.

Results were startling. By mid-afternoon sulphides had been reduced 50%, pH was back to 7.0 to 7.5. By evening sulphides in lift stations decreased by as much as 80%. And, no further odor complaints have been received since! Concrete and positive proof of the superiority of Cloroben in controlling odors and suppressing sulphide formations in sewage!

YOURS ON REQUEST: Authoritative Technical Bulletin, describing Cloroben applications in up-sewer treatment, sewage treatment plant, septic tanks, cesspools, chemical toilets, grease traps, and industrial wastes. Write "CLOROBEN" on postcard or letterhead for your copy, sent you promptly without cost.

CLOROBEN CHEMICAL CORPORATION

115 Jacobus Avenue
South Kearny, New Jersey

Subsidiary of
Standard Chlorine Chemical Co., Inc.

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TL-14 TRACTOLOADER®

Buckets: 1 to 3-yd
Carry Capacity: 5,300 lb
Maximum Lifting Capacity: 11,000 lb
Breakout Force: 17,800 lb
Weight: 14,480 lb
Engine: Allis-Chalmers
81.5 hp — Diesel
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NEW! *medium-size Tractomotive Loader*

with all the working advantages of larger TRACTOLOADERS

- **Big 5,300-lb Carry Capacity**
- **A Family of Buckets to Choose From**

You can really "go to town" moving material with this completely new, medium-size TL-14 TRACTOLOADER.

You can carry as much as 5,300 lb every trip in a bucket that is just the right size for the material you are handling . . . get the highest possible production.

There's a whole family of buckets to choose from — 1 to 3-yd — for heaviest to lightest materials. Your Allis-Chalmers dealer has a list of materials and their weight per cu yd. He will help you select the most practical size bucket for your work.

In addition, you get all the operating advantages of the larger TL-20 and TL-16 TRACTOLOADERS: Such as a full power-shift transmission with *exclusive* ONE-LEVER SPEED AND DIRECTION CONTROL for faster cycles. Longer Reach . . . Greater Stability . . . Strong, Pin-Connected Planetary Axles . . . Safe Dump Cylinder Location . . . Fully Protected Hydraulic System . . . "Hi-Traction" Differentials!

Let your Allis-Chalmers dealer tell you all about this completely new TL-14. Let him show you how it can increase your production, cut your cost. You'll be glad you did.

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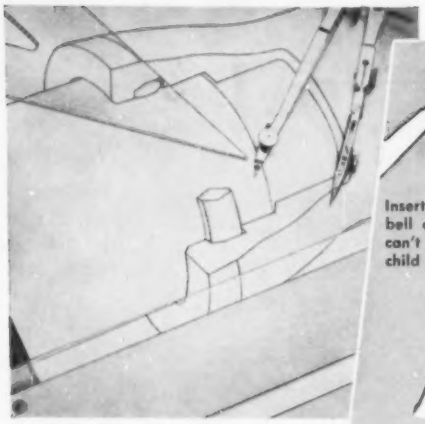

Insert Rubber gasket in bell end of pipe — you can't put it in wrong — A child can do it.

Wipe on a small amount of special lubricant—This reduces friction.

Efficient, Economical

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ALTITE JOINT®

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The **ALTITE JOINT** has been subjected to a series of rigid tests much more severe than are encountered under the most extreme installation and service conditions in the field. Even under extreme conditions, this joint is so simple to install—you could hardly go wrong if you tried.

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Small amount of pressure required to force plain end to bottom of socket—Your simple, time saving joint is completed.

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Commentary

on Water and Sewage Treatment

Recreational Use of RESERVOIRS

R. S. RANKIN

THIS SUBJECT which has strong opponents and equally strong proponents has some interesting variations which so far as is known have not been mentioned by either group. From its title it might be presumed that surface water supplies are obtained predominately from impounded sources and hence all water works authorities must take a stand either for or against recreational use of reservoirs and adjacent lands or at least must be affected by any decisions. It is amazing how divergent are the opinions on this subject. Nevertheless, there is a group apparently going along unmoved or unaffected by this problem, including the substantial number of water suppliers located on the large river systems such as the Mississippi or Missouri and even on sections of the Great Lakes. This group has no control whatever over the uses of its source of supply for various forms of recreation whether it be swimming, boating, fishing or camping on the marginal land. The consumers served by this group seem as healthy as those served from the non-recreational sources. These different attitudes and inconsistencies seem worth reviewing in an effort to determine some underlying reason.

No one can question the desirability of providing the consumer with a naturally clear, potable and palatable surface water supply that requires no treatment, but sources having these qualities are now available only to a limited portion of the population and furthermore they are continually diminishing. The surface supply which can continuously yield quality water without the need for treatment at some time is becoming almost a thing of the past. One might question whether objectors to recreational use of reservoirs are basing their conclusions on facts, on a desire to avoid more treatment, or simply on long established regional custom which eventually may become prejudice. The strict health authority rightly wants to eliminate all potential health hazards to the water supply and possibly reasons that the only means of accomplishment is the prohibition of any and all forms of recreation remotely related to the water supply.

The American Water Works Association is on record as opposing legislation permitting or requiring the opening of domestic water supply reservoirs and adjacent lands to recreational use (1). This is,

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San Jose, California, one of the fastest growing cities in the United States, has standardized on Union Metal 30-foot tapered, fluted steel Monotube poles for all new subdivision lighting.

This type lighting pole not only proved to be the most effective, but the permanency of construction, attractive appearance and economy of installation increased the preference for Union Metal.

Uniform lighting with Monotube poles has proved of value to many cities.

Residential subdivision lighting . . . standardized with 30' Monotube poles mounting incandescent luminaires.

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Josam SWIMMING POOL EQUIPMENT for WATER LEVEL DECK POOLS

The Water Level Deck Type Pool is a more sanitary, safer and more usable pool for all age groups, in addition to being a more economical pool.

The deck level construction permits filling the pool to a level where the bather can roll out of the water to the promenade deck, at any point, in the easy "turtle type" method, without depending on ladders, steps, ramps or other means. This method makes the Water Level Deck Type Pool very advantageous for the instruction of children, paraplegics and other handicapped bathers.

Scum is washed over the coping and out of the pool to accessible drains. The water level which is 1" below the top of the coping, eliminates hard-to-drain scum gutters above the water line and also effects a saving of cost for formed tile gutters and from 8" to 10" of excavation and concrete walls.

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of course, the only position the Association can take. It is not proper for unqualified legislators to decide on matters affecting health even though they are hard pressed by their constituents to take some action. It is a decision which should be made only by the authority responsible for the water quality. However, unless that authority can offer constructive alternates, the time may not be far distant when persistent and vociferous pressure groups will gain their way. The water purveyors must be ready with plans or plants to meet this situation.

When water works men in one section of the country take the position that the impounding reservoirs under their jurisdiction should be maintained forever inviolate, one wonders what they think of their associates who never have and never will be able to exercise control over the recreational uses of their sources of supply. Also what do the latter group think of the former if they give them a thought? Is it possible for the former group to keep on insisting that the only safe source of supply is the one which bars all human activity from its shores?

One can read in water works literature of such places as Springfield, Ill., (2) where the impounding reservoir is utilized to its fullest extent for all forms of recreation including bathing; or of Indianapolis, Ind., (3) where controlled recreational facilities on large impounding reservoirs have created good will and advanced public relations immeasurably. In the west the East Bay Municipal Utility District (4) opened in 1958 one of their upstream reservoirs for fishing after many years of refusing to consider the subject. These three localities have water filtration plants and as a result there has been no question of the water quality being adversely affected. Many other similar examples can be found and insistent public pressure will increase their number.

The argument advanced against opening reservoirs to recreation is the potential hazard of pollution which is, no doubt, a valid one if the supply is not filtered. However, in the example cited any resulting pollution has had no effect on quality of water delivered to consumers because the treatment works readily absorb any incidental increase. It seems obvious then that the opponents are composed principally of those purveyors who rely solely on disinfection and they are not in a position to take any chances. Naturally under these conditions health authorities must support them but with adequate treatment their case would materially weaken. Probably the rigid refusals to consider the subject favorably are based to a large extent on the premise that any relaxation would require filtration of presently unfiltered supplies.

Unrestricted recreation on impounding reservoirs and watersheds obviously is not being advocated and it is admittedly difficult to place a limit on any form of recreation without competent supervision and enforced rules and regulations. Supervision means added cost which must be borne by someone but there is no reason why planned recreation cannot be financed by those sharing the benefits. The extent of facillities provided should, of course, be subject to the approval of the water authority whose first duty always is to provide pure and palatable water.

One wonders whether those opposed to recreational facilities on impounding reservoirs have considered situations in other less fortunate areas. The opinions of the large group of water purveyors deriving their unimpounded supplies direct from rivers

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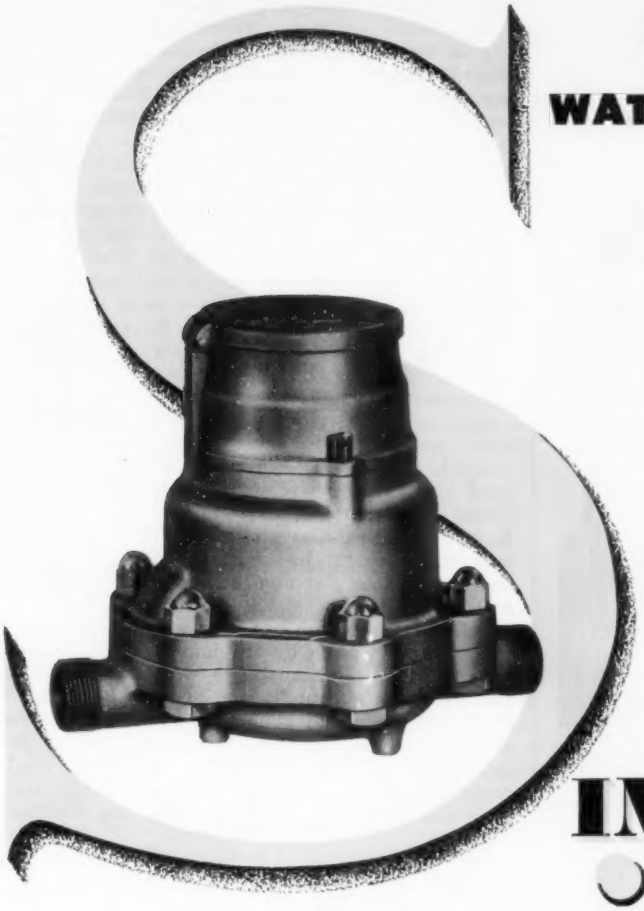
HAVE WHAT THE WATER SUPERINTENDENT WANTS



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- FEWEST PARTS OF ANY COMPLETE METER
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Simplicity in the design of a water meter is important to the Water Superintendent because it reduces maintenance costs.

AMERICAN METERS are simple, uncomplicated — easy to take apart and put together — and best of all you can't put them together incorrectly. AMERICAN METERS have the fewest parts of any complete meter and all parts are interchangeable from one meter to another. Worn parts can be replaced individually without having to buy costly "unit assemblies". The rugged construction of AMERICAN METERS results in many years of trouble-free service. All this means lower parts costs, lower inventory cost, lower repair costs!

Yes, AMERICAN METERS are the answer to the Water Superintendents request for Meter SIMPLICITY.

Replaceable Measuring Chamber Assembly

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The Best 6" Submersible Pump You Can Buy!

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ASHLAND, OHIO KITCHENER, ONTARIO

or lakes would be interesting. The problems of pollution they have to contend with are far beyond any conceivable pollution incident to controlled recreation. Yet consistently they are able to deliver a safe and palatable water to consumers. Faber (5) reporting in 1951 on six plants on major streams treating heavily polluted waters finds the varied operating techniques equal to the problems. When these examples are considered, which are probably extreme, a position which depends for safety solely on maintenance of a closed preserve seems hard to justify.

In a previous commentary it was pointed out that treatment by filtration of practically all surface supplies is the only way whereby a quality water can be delivered to the consumer at all times. If, then, filtration is necessary in any event, and assuming that recreational facilities may at times create some incidental or accidental pollution, the evidence from numerous plants shows that such an exceptional situation could be handled with ease. No one would advocate intentionally increasing pollution in a water supply and by no means is this to be inferred from these comments. However, recreational facilities properly provided and supervised will do more public good for a water purveyor than any incidental pollution can do harm in a system with adequate purification facilities. The staff which now is used to stop trespassers can be used for control of recreation and by judicious planning the operation can produce a revenue.

Public relations are one area where water works executives can profit by any improvement. It seems apparent that those suppliers with the "No Trespassing" rules eventually are going to be forced to give ground and by adding filtration plants they can safely do so and still deliver a quality water. This can be another forward step in the Water Works Advancement program with improved public relations and quality water representing the combined product.

1. AWWA Policy on Recreational Use of Reservoirs. *Willing Water*, February, 1958, Pg. 5.
2. Public Use of Water Property, S. T. Anderson. *Journal AWWA*, 1948, Pg. 949.
3. Recreational Use at Indianapolis. Daniel P. Morse. *Journal AWWA*, 1957, Pg. 1160.
4. East Bay District Policy, John W. McFarland. *Journal AWWA*, 1957, Pg. 1172.
5. Adjustment of Water Treatment to Pollution Loading. Harry A. Faber. *Journal AWWA*, 1951, Pg. 31.

Cost of Cleaning Catch Basins and Sewers

The Buffalo, N.Y., Sewer Authority reports that 447 catch basins were cleaned in the 1957-58 fiscal year at a cost of $1.91 each; in the preceding year, 678 were cleaned at $1.67 each. Previous costs have ranged from $1.20 to $1.44 each. Costs of cleaning 504,665 ft. of sewers in 1957-58 averaged 20.9 cents per foot.

Minnesota Highway Spending

Minnesota spent more on highway construction during the past biennium than in any other similar period in its history. The value of all awarded construction contracts including trunk highways and County-Federal Aid secondary roads was $139,609,034, which breaks down as follows: Trunk highways, $94,595,969; Interstate construction under Federal Aid Act of 1956, $19,213,235; Interstate construction under Federal Act of 1954, $1,592,985; and County-Federal Aid Secondary roads, $25,799,830.

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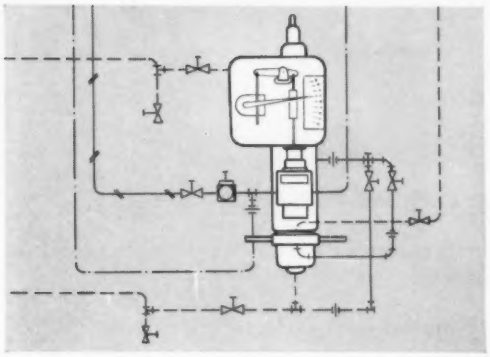
is a Pfaudler Permutit program providing a modern, imaginative approach — plus the specialized materials and equipment — for handling and processing and controlling more profitably the liquids and gases which are the lifeblood of our manufacturing economy.



FLUIDICS AT WORK

New pneumatic transmission system more accurate, more dependable

The diagram shows a typical setup for the new Simplex system for transmitting rate of flow and loss of head to a receiver.

Rate of Flow

The new Type PN transmitter combines the exceptional accuracy and range of a differential converter operated by a mercury float with the traditional dependability of pneumatic transmission.

The transmitter consists of a differential converter which extracts the square root flow function from a primary and then positions a pneumatic motion transmitter. The transmitter produces a pneumatic 3 to 15 psig linear signal. A booster pitot diaphragm in the motion transmitter insures a low lag coefficient and fast transmission.

Besides getting a linear signal without using supplementary pneumatic relays, this new unit gives you point accuracy over wide ranges of flow with minimum differentials. The booster permits accurate transmission over long distances with minimum lag.

Loss of Head

A Type TD transmitter gives accurate readings to within ±1%. It uses no stuffing boxes or relay valves, so both installation and maintenance are simple and economical.

Connected to Simplex Pneumatic Gauges, this new system should give long years of accurate, dependable, trouble-free service.

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Specialists in FLUIDICS . . .
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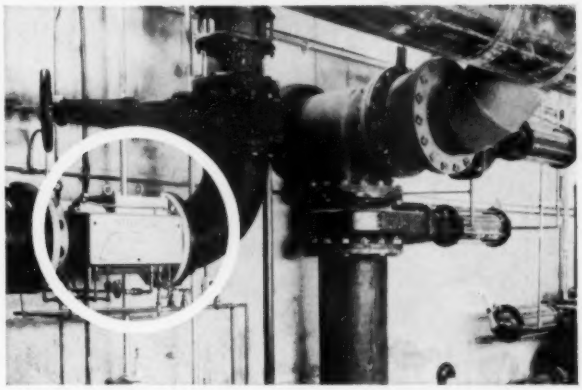

FLUIDICS AT WORK

Modulair Flow Controller installs as easily as a piece of pipe

So simple is this new pneumatic rate-of-flow controller, you can install it in about the time it takes to install a piece of pipe.

The differential producer and the modulator lie in a single housing. The actuator is entirely enclosed in a case which mounts directly on the housing.

Result: No complicated piping or drain system to install and maintain.

For a bulletin giving complete specs and performance data, write to our Simplex Division, Lancaster, Pennsylvania. Ask for Bulletin 951.

Fast, dependable delivery insured by new plant

This is the new $2,000,000 home of our Simplex Division . . . an ultra-modern plant designed from front to back to give you fast, dependable service on valves and meters. New manufacturing techniques, updated assembly lines and ample manufacturing capacity and a complete staff of skilled workers have all been planned around the single objective of getting your orders to you on time and built to your exact specifications.

This stencil tells you 6 important facts about your concrete pipe

- Permanence—welded wire fabric insures durability
- Low cost
- Easy handling and placing
- No maintenance—this is permanent concrete pipe
- Improved structural stability—this pipe won't crack or crumble
- Fireproofness—with no need for special pipe lining

Welded wire fabric reinforcement gives you all these extras. And for the best reinforcement, be sure it's USS American Welded Wire Fabric. USS American Welded Wire Fabric is precision manufactured from extra-strong cold-drawn steel wires. And its quality is rigidly controlled to assure you a fabric that meets every specification—exactly—shipment after shipment.

A type for every pipe—USS American Welded Wire Fabric is made in circumferential wire sizes up to and including ½″ at 2″, 3″, and 4″ on centers. For more information, write to American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS and American are registered trademarks

USS American Welded Wire Fabric is used all over the world for sanitary and storm sewers, highway and railroad culverts, and for airport drainage.

It pays . . . to ask, *"Is it Reinforced"*

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Truck operators derive many worthwhile benefits through the use of Eaton 2-Speed Axles—ability to pull out under full load, quicker trips, safer operation, reduced driver fatigue, longer truck life, greater trade-in value.

But a big reason why more and more truckers in all fields of heavy duty hauling are specifying Eaton 2-Speed Axles is that this equipment effects important reductions in operating and maintenance costs—which is another way of saying: they add to profits!

Ask your truck dealer to show you how Eaton 2-Speed Axles can make big savings in your hauling operation.

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The new lift span on the Celilo Bridge over the Columbia River is being raised to permit river passage. Westinghouse supplied all the major elements of the electrical system, which can raise the span to 75 feet above mean high water in 90 seconds.

Sid Brown, Westinghouse sales representative, at right, is shown discussing approval of electrical control system with Mr. Don Thomas, assistant engineer of structures for Spokane, Portland and Seattle Railway; Mr. Glen Emory and Mr. Ed Bohm, partners of Emory and Bohm, electrical contractors.

Celilo Railway Lift Bridge uses new Westinghouse static skew control

When construction of the Dalles Dam caused the Columbia River to rise closer to the deck of the Oregon Trunk Railway's Celilo Bridge, it became necessary to build a lift span to let river traffic pass beneath. A Westinghouse d-c adjustable-voltage drive, incorporating static skew control, was installed to provide smooth acceleration and a precise regulating system to keep the span level.

Set between two towers, the span is counterweighted and suspended by wire ropes passing over sheaves at the top of each tower. Two Westinghouse d-c mill motors in each tower drive the sheaves and are electrically synchronized by the d-c adjustable-voltage system to keep the span level when operating. The various operations are so interlocked that they must follow a predetermined sequence to assure maximum equipment and personnel safety. The skew control equipment has safeguards against abnormal conditions and requires minimum maintenance.

Westinghouse equipment used on the Celilo Bridge includes: the main d-c drive motors, brakes, motor-generator, control regulating exciters, control board, an operator's console, emergency drive a-c gearmotors and a 225-kva outdoor power center.

Westinghouse, as sole supplier of the coordinated electrical system, assumed undivided responsibility for its overall operation. For further information showing how this complete, single-source supply can benefit you, contact your Westinghouse electrical construction engineer, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94116

Owner: Oregon Trunk Railway (Operated by Spokane, Portland & Seattle Ry.)
Consulting Engineers: Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.
General Contractor: Kansas City Bridge Co., Kansas City, Mo.
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Over 250 Pages Westinghouse Data in Sweet's Construction File.

YOU CAN BE SURE...IF IT'S

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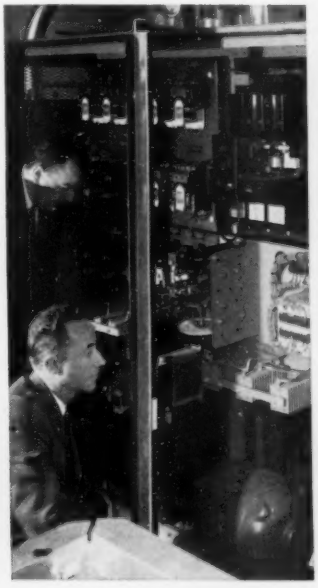
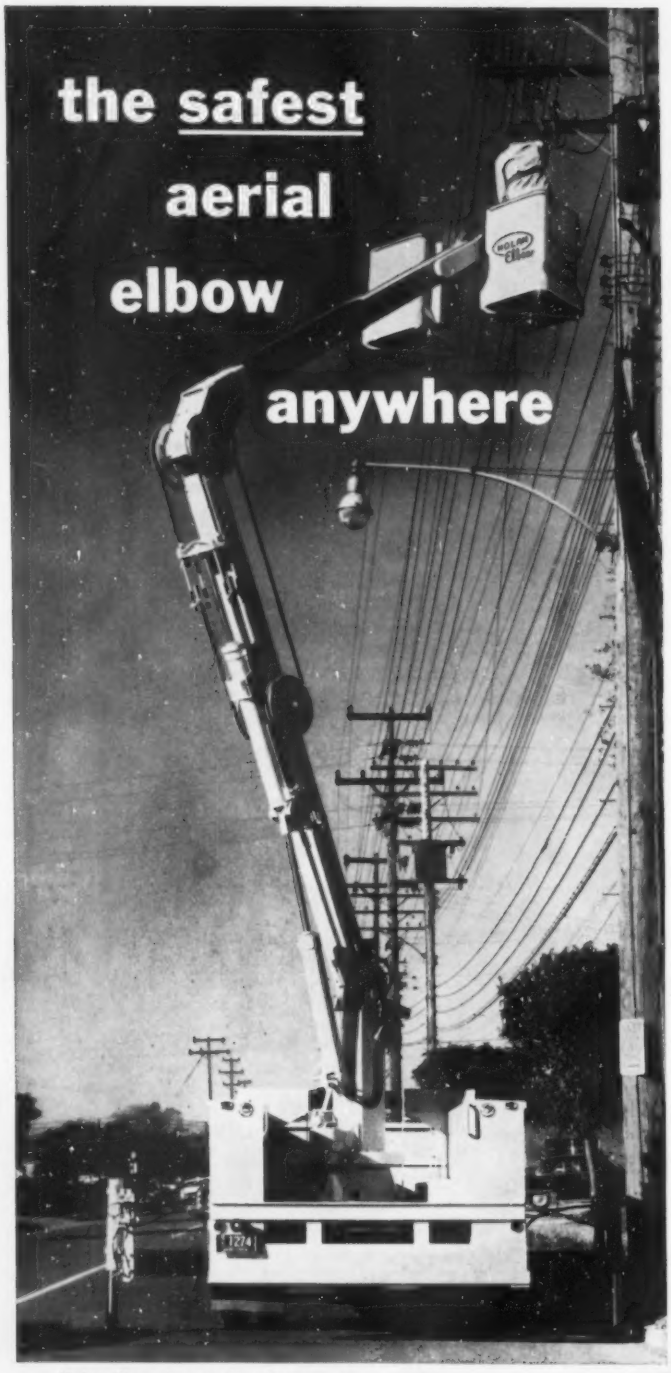
Chief operator, Champ King, at Westinghouse control desk. This desk centralizes the starting and stopping of railway traffic, selection of normal, auxiliary or emergency power supply, normal or emergency drive system and control of the lock and lift span.



Mr. Brown and Mr. Thomas inspect the interior of the main control cabinet which houses the Magamp* regulator panel and Rototrol® elements of the bridge control system.

*Trade-Mark

Mr. Bohm and Mr. Thomas examine the Westinghouse 33-hp Type MCA d-c mill motors, designed for heavy intermittent duty, which drive the main span machinery located at top of each tower.



Holan fiber glass section in upper arm

Holan Elbow has precise aircraft-type cable controls and strong, non-conductive fiber glass section in upper arm

With a Holan Elbow, it's easy to get to the problem—and safe when you get there.

The exclusive cable control system provides easy, precise spotting of the buckets. And a fiber glass section in the upper arm insulates workmen in the buckets from the ground.

The fiber glass section is solid—*not* metal enclosed with fiber glass. Also, control cables and leveling cables have fiber glass inserts so that men in the bucket are completely separated from metal-to-ground contact. In a bucket-to-ground test, the non-conductive fiber glass section withstood 100,000 volts for one minute.

As for strength, in a separate test the fiber glass section required a 6,200-pound load at end before failing. This is a safety factor in excess of 7 as nominal capacity and weight of the buckets total 800 pounds.

Safety does come first but there are many operating features to talk about, too. Write for all the details.

Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Ariz.

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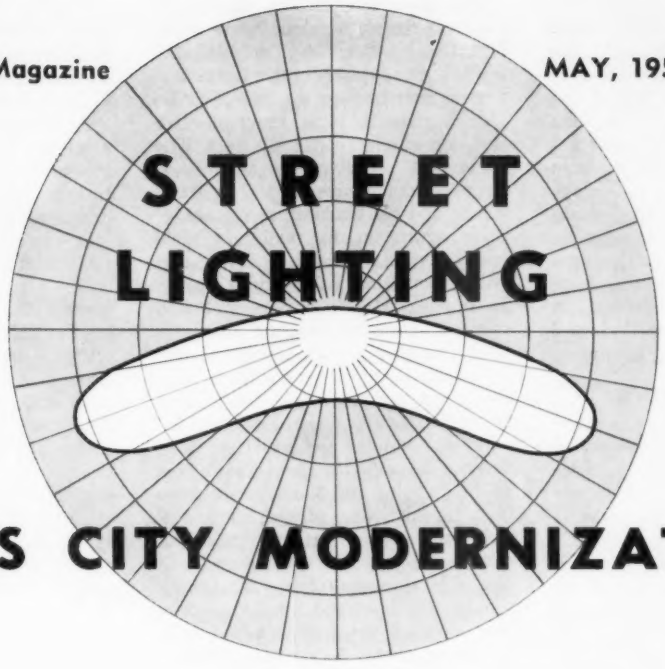


STREET LIGHTING PACES CITY MODERNIZATION

BENTON R. ANDERSON,
City Engineer,
Clinton, Iowa

LIKE MANY other cities, Clinton, Iowa, population 35,000 experienced an industrial expansion following World War II. Three off-street parking lots were constructed with a total capacity of about 800 cars. These parking lots were provided with 54 400-watt mercury vapor lights on 30-foot steel poles. It became very apparent that these installations, by comparison, made then existing business district lighting look inadequate. The old system had been constructed in 1926 with a high voltage series circuit, having a transformer in the base of each light post. The cast iron posts were 10 feet high with a 1000-watt incandescent luminaire mounted on the top. In 1954, a survey by the City Engineer's staff was made and plans were prepared to construct an entirely new business district lighting system. About every possible method of financing was explored and consideration given to almost every possible type of lighting. From time to time, during the discussion, which lasted several years, it was decided to add to the program, until the extent of the original plan was practically doubled and it was then combined with a street widening and resurfacing program.

As an example of how the project snowballed, there was some question about placing any electroliers on Fourth Avenue South. However, the property owners submitted a petition requesting two 600-ft. blocks to be improved by tree removal, widening, new walks, resurfacing and all-new electroliers. The request was granted as this tied in with a 300-car parking lot at each end of this lighted avenue.

On the river front park drive, 25 electroliers, and on South Fourth

● **OLD SYSTEM** of street lights contributed little but glare to the main business district, making it difficult for motorists to see pedestrians crossing the street.

● **NEW LIGHTING** system keeps the pavement bright. 400-watt mercury vapor luminaires mounted on 30-ft. steel poles provide pavement illumination of about 1.2 fc.

Street 24 electroliers, were later added to the program, using wood poles and overhead wiring, the color-corrected luminaire and bracket being the same as the rest of the installation. Eight blocks in the north end shopping district were included in the construction program with the steel pole type of electrolier, the same as the main business district. The luminaires mounted on wood poles with overhead wiring along the park drive and on South Fourth Street, on one side only, were installed and financed by the Power Company.

Method of Financing

The final decision on the method of financing was that one-half of the estimated cost would be paid by special assessments on the frontage of property benefited at the rate of $4.50 per foot. The balance was paid by general obligation bonds. It was pointed out that if the Interstate Power Company financed the downtown project the debt service would be subject to income tax and the interest charge would be almost doubled.

The location of the electroliers was a matter which required a great deal of study and judgment. A detailed plat was prepared, showing all driveways and existing fire hydrants, traffic signals, mail boxes, heated sidewalks, area-ways, the old lighting standards and similar obstructions.

The spacing of the lights averages 100 feet along each curb; the poles on the opposite side being staggered. This might be termed 50-foot staggered spacing. On Fifth Avenue, with a 72-foot width between curbs, this means 88-foot spacing, measured diagonally pole to pole. The pole height was determined by the intensity formula. Many of the citizens claimed that the 30-foot mounting height of the luminaire was too great, but engineers from the Interstate Power Company and the leading manufacturers of this type of equipment agreed that the poles were of the correct height.

The plans for lighting of the two business districts, which were to be financed by the City, included 178 units with underground wiring. The system was broken up into 15 individual circuits with seven double and one single feed contactors. The wiring at crossings of all alleys, streets, driveways and railroad tracks and the leads up to the feeder poles was run in two-inch rigid metal conduit. The City Electrician pulled conductors for traffic signals in some of the conduits and laid cables in trenches in some locations. Cast iron junction boxes were placed in sidewalks with covers flush with the walk surface. These boxes also serve the traffic control cables. All runs of conduits are provided with drains. In all, 105 junction boxes with 85 drains and 3,417 feet of two-inch conduit were placed. Each circuit was started out with two No. 4 strand copper RR cables and one No. 4 bare copper cable. At points where the load indicated, the size was stepped down to No. 6 cables at the pole base. Alternate bids were received on aluminum conductors, but the problem of connectors influenced the choice of copper. The work included underground trenching for conduits and direct burial cable, 8,944.1 lineal feet for No. 4 and 12,904.6 lineal feet for No. 6 cables. A double convenience outlet for Christmas festoon lighting was placed near the top of each steel pole.. Each circuit is controlled by a photo-electric relay mounted at the top of the feeder pole. Meter boxes with breaker switches are also mounted with the relays on each of the eight feeder poles. There are about twelve electroliers in each circuit with a load of 400 watts for the luminaire and about 1,500 watts for festoon lighting, totaling approximately an average of a 25-KW load per circuit.

The greater part of the cable was laid under the sidewalk, as close to the curbing as possible. However, for a portion of the area, the parking meter posts, water boxes, the old light standards, traffic signals and other obstacles made it necessary to follow along a joint about five feet back of the curb; or, in case of heated walks and area ways, to place the trench out in the gutter.

A diamond saw was used to cut a clean, even trench about four inches wide in the sidewalk. The trench was dug about 12 inches deep, about four inches of sand was placed in the trench and the two insulated cables and one bare cable were laid on the sand. A creosoted pine board was next laid on the cables and the trench filled up with sand to subgrade for replacing the concrete sidewalk. The bare cable is connected to a ground rod at the center of each electrolier.

The old lighting system was kept in operation during the installation of the new system. This was difficult as it was a high voltage series affair with a cable laid in the walk where it was often desired to lay the new cables. Temporary circuits were installed by the Power Company to handle these situations.

This phase of the work was followed by asphaltic concrete resurfacing by the State on U. S. Highways 30 and 67 and Iowa 136, and by the City on the other streets. On South Second Street, most of the walks were fifty years old, so the City Council ordered the walks and curbing to be removed and replaced. Certain other streets were widened at the same time. Where the curb and walk had been removed the electrolier concrete bases were poured and the cables laid for 12,-909 feet of trench without sawing. The curb replacement contract totaled about $65,000, and widening about $30,000 plus walks done under private contracts to the amount of about $25,000. The direct burial of neoprene covered cable in sand with the creosoted board protection was considered safe for ordinary use under a concrete sidewalk. However, conduit protection was used at all locations other than under a walk. If it were evident that the walk might be disturbed in the near future, or if some unusual condition existed, just to be on the safe side, metal conduit was installed. In the parking lots, Orangeburg conduit was used under the slab, and metal conduit to the feed points.

Bases for the Poles

The concrete bases for the poles were constructed of reinforced concrete. The poles were all carefully set on a true line and grade. Our principal street is 120 feet wide with a curb width of 72 feet leaving a

● **NEW municipal parking lot overlooking the river is well lighted with pairs of luminaires mounted on steel poles. Modern lighting in parking lots helped to demonstrate that the old street lighting system was inadequate and needed replacement.**

24-foot walk. The Post Office curb is set back into the sidewalk area. From a distance the long line of luminaires gives the appearance of a string of beads, with one bead out of place.

The local firm (The Electric Service of Clinton) to whom the contract

● **TO HOLD the pole bases at a uniform grade it was necessary to rebuild the curbing of high sidewalks as steps.**

was awarded, cooperated with the Interstate Power Company and the City electricians in placing other power and signal conductors in the trenches and conduits. The contractor handles General Electric products, so most of the material was of that manufacture. The construction specifications were the usual standard requirements of the National Electrical Code.

This description of the construction work attempts to point out the problems which arise in attempting to install a new lighting system in a district where no consideration in the past had been given to such an improvement. The use of a diamond blade concrete saw for trenching cuts in sidewalks and gutters solved many problems. A deduction of 21¢ per foot of trench was made where sawing was not necessary. The brick pavement cuts and trenching along the gutters on certain streets were covered when the streets were resurfaced.

The cost of new cables for the traffic signals totaled about $5,000. The feeder poles are all in the alleys about fifty feet in from the lighted streets. In most locations the main conduit extends to a junction box on each curb line. The cable then extends both ways from each junction box and follows around the corners without again crossing the street in most circuits.

Each electrolier base has a long ground rod in the center for connection to the bare cable. The electrolier poles are of tapered round steel with aluminum paint. The base houses the ballast and the fuse panel for the festoon lighting. The cost was estimated on a basis of approximately $795.50 per electrolier. The final estimate shows the cost for 177 electroliers to be $736.14 per unit for the completed contract. Each unit averaged 123.4 lineal feet of cables placed in trench, and 18.1 feet of rigid metal conduit.

The preliminary schedule of assessments based on the estimate of $140,804.40 was filed with the understanding that the City would levy one-half this amount, regardless of the final cost, and pay the difference out of general funds. Apparently all parties were satisfied, which is quite unusual for special assessments. The final special assessments were 57.07 percent of the total cost. The U. S. Post Office and the Iowa National Guard Armory did not contribute to the special assessment fund as they are tax exempt.

The preliminary estimated cost as filed by the City Engineer was $140,804.40; the final contract cost was 92.53 percent of this estimate. The base bid on the Union Metal Monotube steel poles and the 400-watt General Electric mercury vapor luminaires was $130,964.60 for 178 poles, which was 93 percent of the preliminary estimate.

The following were alternate low bids: Deduct for aluminum wire, $5,290.72; add for aluminum poles $15,920.00; add for concrete poles $12,460.00; and add for fluorescent luminaires $11,147.50.

During the course of construction one electrolier was deleted from the contract and used on an overpass project, with two other units. The U. S. 30 Highway Suspension Bridge across the Mississippi River has 49 units of the same type of lighting using aluminum poles. The photo-electric cell which controls the lights is set so that when the intensity of daylight falls to four foot-candles, the lights turn on.

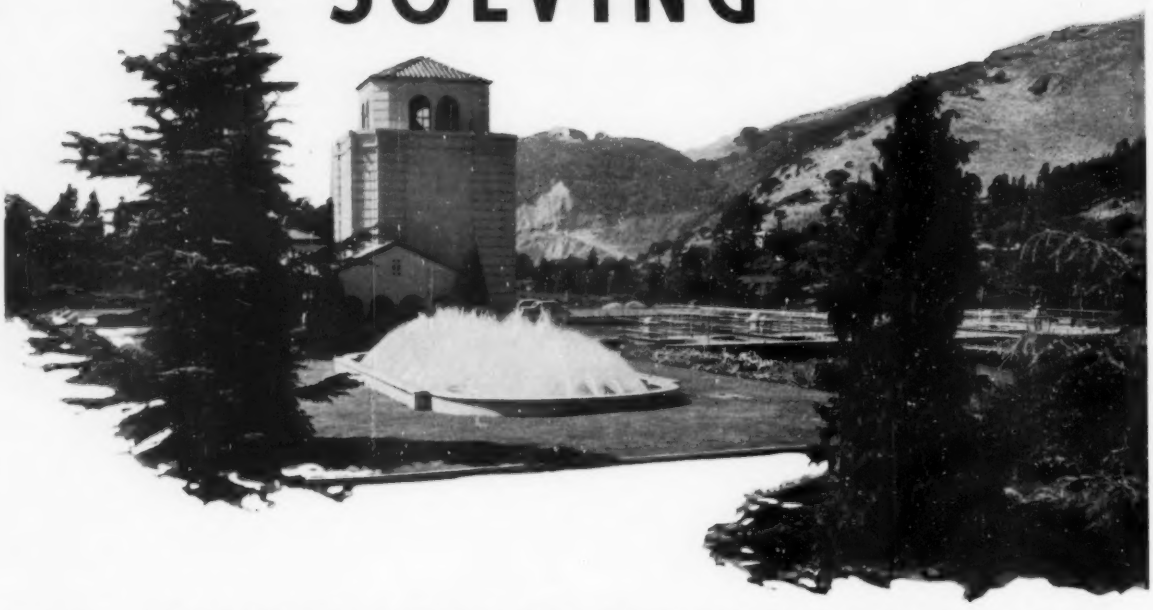
The new lights using 400 watts give 19,000 lumens of light, as compared with the old lights using 1,000 watts and giving half as much light. The light intensity costs about one-fifth as much as for the old system.

Table 1 shown herewith is a tabulation of the unit costs as shown in the final estimate paid to the contractor.

Table I—Final Estimate Paid to Contractor

No.	*Item*	*Unit*	*Price*	*Total*
177	Electroliers without concrete base, including festoon outlet, installed per plan with round steel pole and mercury vapor color corrected luminaire	(a)	$356.00	$ 63,012.00
175	Reinforced concrete bases for electroliers Types "A" and "C"	(a)	81.00	14,175.00
2	Reinforced concrete bases for electroliers Type "B"	(a)	200.00	400.00
105	Pull boxes or junction boxes with metal cover	(a)	125.00	13,125.00
85	Drains for metal conduit	(a)	33.00	2,805.00
170	lin. ft. One-inch rigid metal conduit to photo cells	(a)	0.80	136.00
3,417	lin. ft. Two-inch rigid metal conduit	(a)	1.05	3,587.85
8,944.1	lin. ft. trench for No. 4 copper RR cables with cables and sand and creosoted board with sawed cuts in concrete sidewalks and concrete pavements, including trenching for metal conduits copper wire	(a)	1.51	13,505.59
12,904.6	lin. ft. trench for No. 6 copper RR cables with cables and sand and creosoted board with saw cuts in concrete sidewalks and concrete pavements, including trenching for metal conduits	(a)	1.45	18,711.67
7	Double feed contactors installed complete	(a)	464.00	3,248.00
1	Single feed contactors installed complete	(a)	303.00	303.00
				$133,009.11
12,909.8	Deduct from bid price on item per lin. ft. of trench for No. 4 cable and trench for No. 6 cable where saw cut is not necessary.	(a)	0.21	— 2,711.06
		Net amount		$130,298.05

SOLVING



THE WATER AND SEWERAGE PROBLEMS OF COUNTY URBANIZATION

HERBERT G. CROWLE,

Director of Public Works,
Alameda County,
Hayward, California

THE SOLUTION of water and sewage problems in a great and rapidly growing metropolitan center is a challenge to the skill and effectiveness of public works officials. Success in meeting these problems during the past decade and continuous planning to meet them in the future have made Alameda County, California, one of the bright spots of the nation in providing facilities for industrial, commercial and residential development. To appreciate the magnitude and nature of the problems, it is necessary to understand a few facts about the location, topography and population of this outstanding county, and the public agencies which provide its services.

Alameda County is situated adjacent to the eastern shore of San Francisco Bay. It has a shoreline of some 40 miles on the bay and extends inland 43 miles to the San Joaquin Valley. The total area is 843 square miles.

Elevations vary from sea level along San Francisco Bay and the San Joaquin Valley to 3,850 feet above sea level in the Valpe Ridge near the center of the southern boundary. The heavily populated westerly portion of the County, lying adjacent to San Francisco Bay, consists of an alluvial plain varying in width from 2 miles in the northerly part to 8 miles in the southerly part. This alluvial plain slopes gradually from sea level at the Bay to 50 to 150 feet above sea level at the base of the first range of hills.

Inland from the bay, and running in a generally northwest-southeast direction, are several ranges of hills. Beyond the first range, in the easterly portion of the county, lies the Livermore-Pleasanton Valley. The valley floor is a flat, sloping plain, some 72 square miles in area, and varying in elevation from 300 feet above sea level at the westerly end to 600 feet at the easterly end. This valley is completely surrounded by mountains, with a narrow gorge, known as Niles Canyon, serving as the outlet at the westerly end.

The population increased from 513,011 in 1940 to 740,315 in 1950, an increase of 44 percent during the decade. Present estimated population (January 1959) is more than 900,000 and the 1960 census is expected to show nearly 1,000,000. When the county approaches full urban development 50 to 100 years from now, the population will reach an estimated 3 to 4 million. Planning of facilities for the future must take this into account.

The thirteen incorporated cities in Alameda County are Albany, Berkeley, Emeryville, Piedmont, Oakland, Alameda, San Leandro, Hayward, Union City, Fremont, Newark, Pleasanton and Livermore. Major unincorporated urban communities are San Lorenzo and Castro Valley. The largest city is Oakland, with a present population of some 400,000.

The available water in local streams and underground basins within Alameda County is sufficient to furnish only a fraction of the needs of the growing industry and population. Consequently, the principal problem with respect to water supply is the importation of water from distant sources. Securing the necessary water rights in a semi-arid State like California is a major undertaking. Financing the impounding dams and long aqueducts requires the most thorough study and planning.

Most of the area of the County, about 92 percent, drains westerly into San Francisco Bay. The problem of sewage disposal is primarily

one of conveying the raw sewage to treatment plants generally located adjacent to the bay shore, providing adequate treatment to prevent pollution of the bay waters, and disposing of the effluent through outfalls which extend into the bay. Because of the 40-mile length of the shoreline and the relatively long and narrow strip of urban development adjacent to this shoreline, sewage disposal to date has been through a series of treatment plants and outfalls located at intervals along the shore.

Flood control and storm drainage are also major problems. A number of substantial streams rise in the hills in the easterly part of the county and flow through the heavily populated alluvial plain adjacent to the bay shore. All of these streams must be improved to prevent flooding and erosion and provide sufficient capacity for the increased runoff caused by urban development. Wide channels must be dredged and levees constructed through the tidelands. Conservation dams in the hills and tidal control structures adjacent to the bay shore are necessary to provide adequate facilities.

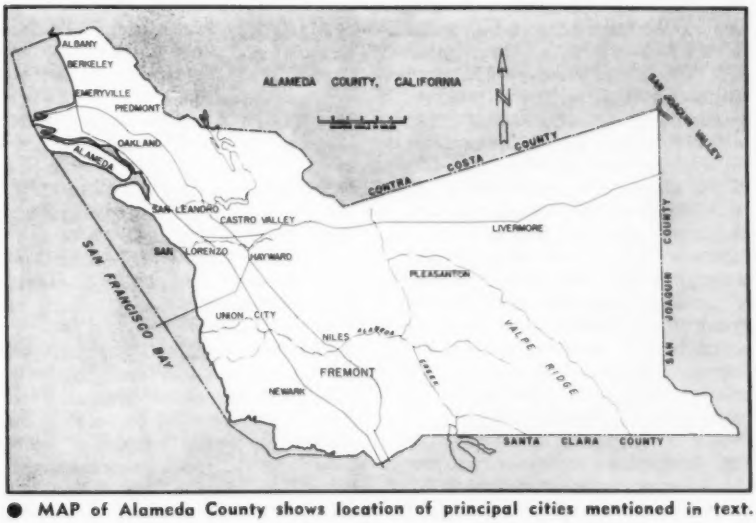
Although the provision of facilities required for urban development in Alameda County during the past decade had been considered by many to be outstanding, the industrial and local government officials were not satisfied. With characteristic foresight, the Board of Supervisors of the county in 1957 engaged the Urban Land Institute to make a survey of the requirements for future urban development. The findings and recommendations of the Institute constituted a blueprint for action. Using the County as the co-ordinating agency, the various cities and districts which provide essential services began an intensified program of study and co-operation to accomplish the necessary objectives.

● **CHANNELS pictured above represent a small portion of the extensive flood control system that protects property in Alameda County. One of the five water filtration plants in the East Bay Municipal Utility System is shown on opposite page.**

The findings of the Urban Land Institute indicated, among other things, the need for a comprehensive survey of sewage and industrial waste disposal in the portion of the county lying south and east of the City of Oakland, constituting 80 percent of the area of the county. The co-operating agencies agreed to order first a "basic study", or compilation and analysis of existing data, before embarking on the more extensive and costly comprehensive survey, in order to determine the necessity or justification of such a comprehensive survey; and, if it proved necessary, to make possible an accurate and detailed outline of the scope of the survey. Accordingly, in June 1958, the county, in co-operation with the cities of Fremont, Hayward, Livermore, Newark, Pleasanton and San Leandro, and the Alameda County Water District, the Castro Valley Sanitary District, the Oro Loma Sanitary District, and the Union Sanitary District, engaged the engineering firm of Clyde C. Kennedy to make the basic study. The report, completed in December, 1958, compiled and analyzed the basic data, recommended further study, and outlined in detail the items that should be included in the comprehensive survey. The co-operating agencies are now studying the report and giving consideration to future steps in the never-ending program for planning, improving, and extending sewage and industrial waste disposal facilities. This is but one example of the high degree of co-operation among local public agencies in Alameda County.

Perhaps the best way to explain how the water and sewage disposal problems are being solved is to list briefly the principal local agencies providing services in these fields and to describe their current situations and programs. It is a remarkable story of progress in public works.

The County, in recent years, has served as a co-ordinating agency in the fields of water supply and sewage disposal. Emphasis in the co-ordination program has been in the southern and eastern portions of the County, where a relatively large number of independent public agencies perform operating functions in these fields. There are no laws requiring such co-ordination, so the program has been developed entirely through the voluntary co-operation of the various public agencies involved. Two advisory committees have been appointed by the county Board of Supervisors to achieve the desired results: the Alameda County Water Resources Committee and the Alameda County Sewage Disposal Committee. Both of these committees include representatives of the public agencies concerned, and the water resources committee also includes representatives of industry, business, agricul-



● **MAP of Alameda County shows location of principal cities mentioned in text.**

ture and other interested groups. These committees meet periodically, discuss matters of mutual interest, and arrive at majority decisions on adoption of policies which will achieve the desired co-ordination. Results from that point on depend on voluntary action by each agency concerned. Co-operative agreements or contracts between agencies have been executed to provide for financing of certain planning studies and some minor construction projects.

East Bay Municipal Utility District. This District serves water to the northwestern part of the County, from San Lorenzo and Castro Valley north, and to western Contra Costa County, which is the adjoining county on the north. John W. McFarland is the General Manager. The District presently impounds water behind Pardee Dam on the Mokelumne River in the Sierra

● **THOUGH two aqueducts cross this flood control channel, the hydraulic design provides an adequate waterway.**

Nevada, 100 miles to the east, and conveys it to terminal reservoirs in the East Bay Area through two large, parallel aqueducts. The water system presently serves 1,100,000 persons in the two counties an average of 140 mgd. Water quality is high. Voters of the District in June, 1958, approved by a margin, well over the necessary two-thirds majority, a bond issue of $252,000,000 to finance additional dams, reservoirs, filter plants, pumping plants, distribution mains and a third aqueduct, 87 inches in diameter, from the Mokelumne River. The financial strength and soundness of the East Bay Municipal Utility District is demonstrated by the program to finance this $252,000,000 bond issue without an increase in either the District tax rate or water rates. The expanded facilities to be provided by this financing program is expected to assure an ample supply of water for the foreseeable needs of the District.

The Utility District in 1944 created Special District No. 1 to collect and provide treatment and disposal of sewage from the local sewerage systems of Albany, Berkeley, Emeryville, Piedmont, Oakland and Alameda. The designed capacity of this $23,500,000 sewage disposal system is 290 mgd. All underground portions of the system have been constructed with sufficient capacity to meet the area's needs of the year 2000. Treatment of combined domestic and industrial sewage is of primary type with pre-chlorination, screening and grit removal, sedimentation and sludge digestion. Disposal of the effluent into the bay is by a long outfall pipeline extended to deep water.

San Leandro. This city receives its water supply from East Bay Municipal Utility District, but owns and operates a sewage disposal system which serves some 35,000 of the city's 64,000 population. G. Homer Hamlin is Director of Public Works of the city. The sewage treatment plant has separate facilities for treating domestic sewage and industrial wastes. Industrial waste is treated in primary treatment units while domestic sewage is treated in primary and secondary treatment units. The design capacity of the treatment plant is 3.0 mgd for domestic sewage and 4.0 mgd for industrial wastes. Treated effluent is discharged into a tidal channel which flows into San Francisco Bay. The city is making plans to improve the treatment and disposal system to meet future requirements and to overcome problems created by restriction of the tidal prism resulting from reclamation of tidelands for airport expansion offshore from San Leandro's sewage treatment plant.

Oro Loma Sanitary District. Lying immediately south of San Leandro and north of Hayward is the Oro Loma Sanitary District of which Gerald L. Worthley is General Manager. Oro Loma serves 60,000 people within its District boundaries, and, in addition, some 29,000 in the City of San Leandro, 35,000 in the Castro Valley Sanitary District, and 1,000 in the City of Hayward, or a total population of 125,000. The sewage treatment plant of the Oro Loma Sanitary District is a primary treatment plant designed to treat 8.5 mgd of combined domestic and industrial sewage. Additional treatment capacity is now being constructed and future construction is planned. The treated effluent is discharged directly into the bay.

Castro Valley Sanitary District. This District serves a population of 35,000 in the unincorporated urban community of Castro Valley. Everett Wright is the General Manager. The Castro Valley system discharges all of its sewage, which is principally domestic, into the Oro Loma system for treatment and disposal. Plans are in progress to decrease infiltration into the sewerage system and to provide for service to anticipated future residential developments in the hill and canyon areas immediately to the east.

Hayward. The City of Hayward operates both its own sewage disposal system and water system, serving a population of 65,000 in the city and the immediately surrounding area. Edward E. Phillips is Director of Public Works and Douglas S. Cruickshank is City Engineer. The existing sewage treatment plant, located in the westerly part of the city, provides primary and secondary treatment of combined domestic sewage and industrial waste, and has a design capacity of 5.0 mgd. Treated effluent is discharged into a flood-control channel which empties into San Francisco Bay about one mile to the northwest of the plant. City voters recently approved a bond issue to finance expansion of the system to meet future growth and to construct a second treatment plant in the southern part of the city.

The Hayward water system operates its own wells and presently obtains most of its supply through its own 24-inch pipeline connecting to the Hetch Hetchy Aqueduct of the City of San Francisco in the City of Fremont, 10 miles south of Hayward. Water treatment includes both chlorination and fluoridation. Present water service is about 8.0 mgd. The recently approved bond issue includes funds for expanding the water distribution, storage and service facilities.

Alameda County Water District. Originally created forty years ago to protect the surface and underground water rights of its property owners, the Alameda County Water District, containing some 92 square miles of territory in the Fremont-Newark-Union City area, has in recent years become an important water conservation and water service agency. Matt Whitfield is General Manager and Chief Engineer. Most of the water used within the District is pumped from wells by individual property owners, primarily agricultural and industrial users. The District conserves water through operation of percolation facilities, consisting mainly of abandoned gravel pits adjacent to Alameda Creek in the City of Fremont. The percolation facilities introduce

additional water into the underground gravels of the Niles Cone, which is the principal source of ground water in southern Alameda County. Intrusion of salt water into the underground aquifers is a serious problem in this area. The District also serves water to urban users in Newark and most of Fremont, at a present rate of about 4 mgd. Expansion of the distribution system is under construction. Planning for possible upstream storage and utilization of imported water is in progress.

Fremont. Special mention should be made of the unique City of Fremont. Its 99-square-mile area makes it the largest city in area in Alameda County and third largest in the State of California. Present population is about 35,000 and future prospects indicate an extremely rapid growth. Warren Gonnason is Director of Public Works. Sewage disposal is provided by the Union Sanitary District, which is described later. Water supply in most urban developments in the city is provided by the Alameda County Water District. Most agricultural users and some industries have their own wells. The Citizens Utilities Company serves water to a portion of the city, in the northeastern part. Substantial areas within the city limits are presently outside any water or sanitary district. Land use within the city boundaries is still predominantly agricultural, but residential, commercial and industrial developments are moving in rapidly. Fremont, incorporated as a city only 3 years ago, is destined some day to become one of the most populous cities in California.

Newark. The newly incorporated City of Newark, with a present population of 8,000 is an important residential and industrial city. Shelley Jones is Director of Public Works. Water service is by Alameda County Water District and individual wells, and sewage disposal by Union Sanitary District.

Union Sanitary District. The Union Sanitary District serves a present population of 40,000 in the Fremont-Newark-Union City area. Raymond A. Boege is District Manager and Chief Engineer. Several industries capable of producing strong industrial wastes are located within the district. Two sewage treatment plants, one located near the westerly boundary of Newark and the other near the southern boundary of Fremont, provide primary treatment of combined domestic and industrial sewage. The design capacity of the Newark plant is 3.0 mgd and of the southern Fremont plant 0.4 mgd. District voters recently approved a $6,000,000 bond issue to finance expansion of the collection system and the treatment plants. Substantial future growth of population and industry is anticipated.

Pleasanton. The City of Pleasanton owns its sewerage and water systems, serving its present population of 4,000. Donald Christen is City Administrator. Water supply is obtained from wells. The sewage treatment plant is a secondary treatment plant for combined sewage, with holding ponds with a design capacity of 0.75 mgd. Disposal of the plant effluent is by two means. One is by irrigation type land disposal and the other by percolation and overflow into an adjacent drainage channel. Additional treatment facilities are planned for early construction to augment the present plant.

Livermore. The California Water Service Company serves water from their wells to the City of Livermore. The city has its own sewage disposal system, serving its population of 13,000. Donald M. Bissell is the Director of Public Works of the city. The existing primary treatment plant is presently being replaced by a new secondary plant with a design capacity of 2.5 mgd. Effluent will be stabilized in ponds and discharged into a dry creek. Expansion of the collection system is also in progress.

Alameda County Flood Control and Water Conservation District. As mentioned above, the problems of conservation and control of flood and storm waters is a major problem in Alameda County. In 1949, the State Legislature created the county-wide Alameda County Flood Control and Water Conservation District, with broad powers for the control and conservation of flood and storm waters and importation of water into the District. James F. Vivrette is District Engineer-Manager. At the present time this District, through various zones which have been established, is carrying out a $25,000,000 construction program for flood control, storm drainage and water conservation. Many millions of dollars of flood damages have been prevented by the works completed to date. A master plan of flood control for the District is nearing completion. Within a few years, Alameda County will have one of the best and most complete flood control systems in the country. A $7,000,000 Federal flood control project is expected soon.

Since 1950, the District has taken the leadership in co-ordinating the planning for the proposed South Bay Aqueduct, a unit of the Feather River Project, which has been authorized by the California Legislature for construction by the State. The South Bay Aqueduct is designed to import some 240,000 acre-feet of water annually from the Central Valley at the northeastern corner of Alameda County into southern and eastern Alameda County and portions of Contra Costa and Santa Clara counties. The cost of this aqueduct is estimated at $37,000,000. Funds for starting construction will be requested at the 1959 session of the California Legislature. Local agencies will contract to repay the State for all reimbursable costs.

Personnel of the Alameda County Flood Control and Water Conservation District constitute a Division of the Alameda County Public Works Department, under the jurisdiction of the writer.

● **SEWAGE and industrial wastes of six cities is treated at this plant. Design capacity is more than 275 mgd.**

The people of Alameda County are confident that they can continue to solve their water and sewage problems as they have done so well in the past. Each local agency has under way plans and programs for serving the anticipated great future growth. Co-operation among the County and the cities and the districts for providing these services will continue to be an outstanding characteristic of this great metropolitan area. The common meeting ground of public works officials provided by the Northern California Chapter of the APWA is an important factor in this co-operation.

The writer wishes to acknowledge, with appreciation, the assistance of Robert B. River of the County Public Works Department staff in compiling and preparing data and information for this article, and the valuable technical information pertaining to the sewage disposal systems furnished by the Engineering Office of Clyde C. Kennedy.

REFUSE COLLECTION AND DISPOSAL OPERATED AT A PROFIT

H. H. BECKER,

Waste Removal Department, Stockton, California

CONTRACT arrangements for both collection and disposal of refuse have been advantageous to Stockton, Calif., in providing an efficient operation and one that has received the commendation of state and county health authorities. In 1940, the City entered into a franchise contract with a "scavenger association," which is incorporated and consists of 35 stockholders who are the actual collectors. The rate to be charged for collection is agreed upon between the City and the association. Twenty percent of the gross take is retained by the City, in consideration for which the City provides a disposal site and the labor to operate it.

Disposal is by sanitary landfill, also handled by contract, negotiated for a five-year term. The City specifies the size and placement of the trenches, the degree of compaction and the amount of cover. The operation is periodically inspected to ascertain compliance with the specifications and to enforce strict adherence to safety and health regulations. The contractor builds and maintains all dumping platforms and roads except the main access road to the fill site. Equipment is furnished by the contractor, except that used for fire fighting. He also provides all necessary insurance for protection of the City, the public and his own employees, and posts a performance bond. The current contract was accepted on the basis of 15 cents per cubic yard for uncompacted refuse. In 1958, the average monthly payment to the contractor who operates the landfill was $3,350.

Between 600 and 700 cubic yards of garbage, rubbish and cannery waste is handled daily from the metropolitan area population of 125,000. The refuse is delivered to the disposal site six days a week between the hours of 8 a.m and 4 p.m. Until January, 1958, the fill location was three miles south of the City. With this area exhausted, a new site was obtained at that time, eleven miles from the city.

The trenches are 15 feet deep and 15 feet wide. The City requires that they be dug 300 lineal feet ahead of operations at all times to safeguard against equipment breakdown. The refuse is compacted in the trench and then covered with a layer of earth compacted to a thickness not less than one foot. The final cover of earth is at least four feet thick. This is leveled to a specified grade, allowing a tolerance of six inches. The equipment used by the contractor consists of International bulldozers, a No. 14 and a No. 18, and a Unit dragline with a 45-ft. boom and a ½-yd. bucket. The operation is handled by three men.

Supervision and coordination of both collection and disposal operations are provided by the Superintendent of Waste Disposal. The City's profit from the system has increased each year in accordance with population growth, and in 1958 the net profit was approximately $49,000.

● **ACCESS road to the disposal site is maintained by the City. A portion of the completed fill appears in background.**

● **CONTRACTOR'S equipment at the site includes this Unit dragline with ½-yd. bucket and two International bulldozers.**

BITUMINOUS CONCRETE PLANT INSPECTION

F. M. WILLIAMS,

First Assistant Engineer of Tests, Ohio State Hwy. Testing Laboratory, Columbus, Ohio

IN THE administrative organization of the Ohio Department of Highways the State Highway Testing Laboratory is charged with the responsibility for the design of bituminous concrete mixtures and the inspection of bituminous concrete manufactured for Department projects and maintenance orders. The Bituminous Concrete Section of the Laboratory is primarily responsible for the discharge of this function.

When the Department initiated its asphaltic concrete program in 1930, some 50,000 tons of bituminous concrete were obtained that year for all purposes. In 1957 and 1958 the Department obtained 3 million and 2.4 million tons respectively. In the early 30's not more than four or five plant operations were carried on simultaneously. During 1957, eighty plant operations were carried on during each of two weeks. For six consecutive weeks, bituminous concrete production for State work averaged over 200,000 tons per week. Prior to 1957 maximum weekly bituminous concrete production did not exceed 100,000 tons.

Bituminous Concrete Plant Inspectors and Field Centrifuge Operators are employed by the twelve Division Offices of the Department. These men are given other assignments when their services are not required for inspection at bituminous concrete plants. During the time they are assigned to bituminous concrete plants they are responsible to the Testing Laboratory for the performance of their work. In general, one plant inspector, one field centrifuge operator and one ticket writer are assigned to each plant operation.

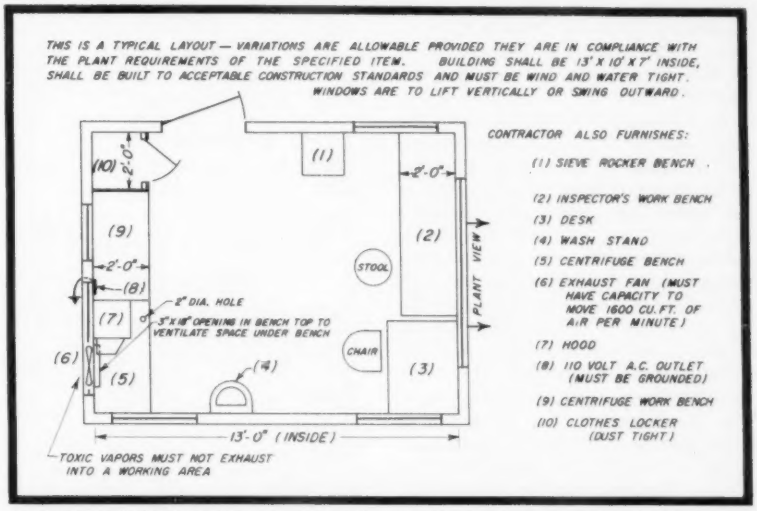
Each spring, the Laboratory conducts a training program for all new personnel prior to assignment as a bituminous concrete plant inspector or field centrifuge operator. This work is carried on in several of the field laboratories through cooperation with the bituminous concrete producers. Groups of about 24 men are given intensive training for three days with one instructor assigned to each group of six trainees.

On-The-Site Training

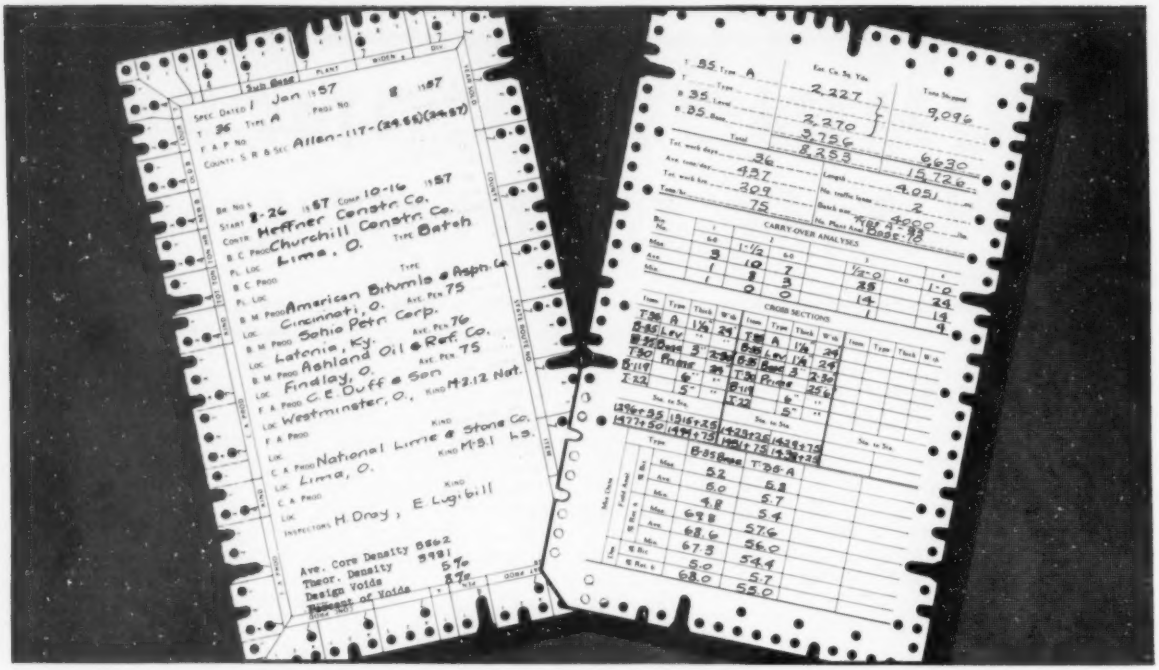
The men are given on-the-site training in sampling of aggregates and bituminous material and the field testing of aggregates for gradation. The plant operation is demonstrated to them and as the plant is usually in operation samples of asphaltic concrete are obtained. Training is given in the selection and testing of bituminous concrete samples with the field centrifuge. Each man must be competent to multiply and divide by means of a slide rule prior to this training program. Instruction is given in the preparation and submitting of the several reports made out by the inspectors.

The instructors are traveling engineers or inspectors who have had extensive experience as plant inspectors. These men, with some others of similar experience also assist the head of the Bituminous Concrete Section during the construction season by covering the start of plant operations, checking trouble spots and assisting plant inspection personnel from time to time during the course of the work.

The Department's Construction and Material Specifications cover requirements for Bituminous Concrete Plant Equipment under Section CE-3. The several bituminous concrete requirements are covered under Item B-34, Bituminous Premixed Base and Leveling Courses; Item B-35, Asphaltic Concrete Base and Leveling Courses; Item B-50, Hot - Mixed, Hot - Laid Asphaltic Concrete Base and Leveling Courses; Item T-34, Bituminous Premixed Surface Course; Item T-35, Asphaltic Concrete Surface Course and Item T-50, Hot-Mixed, Hot-Laid


THIS IS A TYPICAL LAYOUT — VARIATIONS ARE ALLOWABLE PROVIDED THEY ARE IN COMPLIANCE WITH THE PLANT REQUIREMENTS OF THE SPECIFIED ITEM. BUILDING SHALL BE 13' X 10' X 7' INSIDE, SHALL BE BUILT TO ACCEPTABLE CONSTRUCTION STANDARDS AND MUST BE WIND AND WATER TIGHT. WINDOWS ARE TO LIFT VERTICALLY OR SWING OUTWARD.
CONTRACTOR ALSO FURNISHES:
(1) SIEVE ROCKER BENCH
(2) INSPECTOR'S WORK BENCH
(3) DESK
(4) WASH STAND
(5) CENTRIFUGE BENCH
(6) EXHAUST FAN (MUST HAVE CAPACITY TO MOVE 1600 CU. FT. OF AIR PER MINUTE)
(7) HOOD
(8) 110 VOLT A.C. OUTLET (MUST BE GROUNDED)
(9) CENTRIFUGE WORK BENCH
(10) CLOTHES LOCKER (DUST TIGHT)
(10)
2'-0"
(1)
2'-0"
(9)
(2)
2'-0"
STOOL
(8)
(7)
2" DIA. HOLE
3"X18" OPENING IN BENCH TOP TO VENTILATE SPACE UNDER BENCH
PLANT VIEW
CHAIR
(6)
(5)
(4)
(3)
13'-0" (INSIDE)
TOXIC VAPORS MUST NOT EXHAUST INTO A WORKING AREA

● **FIELD LABORATORY is furnished by the Contractor for the exclusive use of Highway Department personnel. Suggested layout includes elevations and details of the sieve rocker bench and ventilated hood, in addition to the plan shown above.**



● **RECORDS of about 4,000 projects are maintained by the Laboratory. These show mix designs and materials sources used.**

Asphaltic Concrete Surface Course. Item T-35, Asphaltic Concrete Surface Course is used far more extensively than the other Items.

At a convenient time prior to the manufacture of bituminous concrete for a State project, the Division Office notifies the Laboratory that the plant equipment is ready for inspection. One of the Laboratory's traveling engineers or inspectors is assigned to look over the equipment for conformance with Specification requirements. The "Bituminous Concrete Plant Inspection Report" is submitted to the Laboratory for the pertinent plant and project. The items found not to conform with specification requirements are brought to the attention of the Division Engineer of Construction who in turn brings them to the attention of the Contractor. The Department's Engineer of Construction is tied in with copies of these communications. The Division Office notifies the Laboratory of the correction of these items prior to or simultaneously with making its request for starting bituminous concrete production. In general, these inspections are made for the first operation of a plant in any construction season or following periods of a month or more of nonuse or use on other than State work. Where the plant operation is satisfactory and is reasonably continuous on State work, resealing of the plant scales will be required from time to time without the formality of making the complete plant inspection.

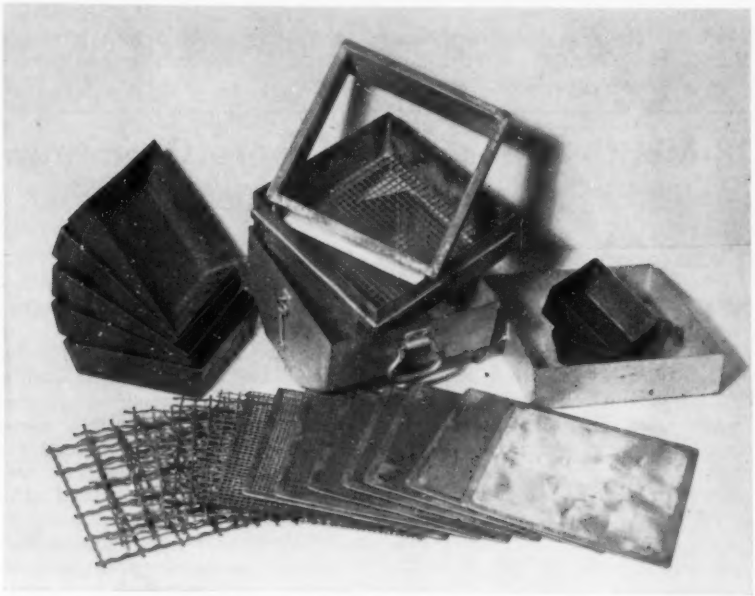
Obtaining Samples

The Division Engineer of Tests is responsible for obtaining samples of the material that will be used in the work and submitting them to the Laboratory so as to permit completion of the tests in advance of plant operation. In general, bituminous materials shipped during the progress of the work are accepted on the basis of samples sub-

● **INSPECTOR'S kit packs into compact box in background. It contains all of the necessary materials and supplies except the sieve set, centrifuge and report forms.**

mitted by plant inspectors maintained by the Testing Laboratory at the principal bituminous material sources available to Ohio. Where material is not plant inspected, the Contractor must provide adequate storage to permit sampling and testing after the material is received. A random check sample is submitted by the plant inspector once each week.

When a date is set to begin the bituminous concrete plant operations for State work, the Division informs the Laboratory of this, providing at least two days' notice. At the start of plant operations the Laboratory assigns one of its traveling engineers or inspectors to assist the plant inspector, field centrifuge operator and plant ticket writer. In instances where one State project immediately follows another State project and the plant personnel are familiar with the mixes for the new project, a traveling engineer may not be assigned at the start of the work.



● **BITUMINOUS material is removed from samples of mix by use of a solvent and the centrifuge. Aggregate is then dried, separated by field sieve set and weighed.**

It is the responsibility of the traveling inspector to know that the materials used have been tested and approved; to know that the indicated plant corrections have been made prior to plant operation; to see during the initial stages of operation that all of the plant components affecting the manufacture of the mix function properly; and to be certain that the mixture complies with Specification requirements at the outset.

The operations of the plant inspector, field centrifuge operator and ticket writer are checked over to insure they are following the proper course. The traveling engineers or inspectors may be assigned to check back on a project in operation when necessary.

The inspector is supplied with a "Bituminous Concrete Data Sheet" for each project which provides the following information: Project identification data; quantities of each type of bituminous concrete called for by the project; specifications governing the contract; mix design data, the percent of bitumen and the percent retained on a No. 6 sieve; suggested batch weights for batch plants; and items of plant equipment that failed to meet Specification requirements.

Where a batch plant is used, the suggested batch weights and fluidometer settings supplied are based on Laboratory records of projects completed by this plant with materials from the same sources. Each continuous-mix plant is calibrated for each project prior to manufacture of bituminous concrete with the plant set-up based on this calibration.

Bituminous concrete mix designs are based primarily on experience with the use of materials from the aggregate and bituminous material sources used. The Laboratory has records for about 4000 prior projects, covering the past 28 years. These data are supplemented by means of the Marshall and Hveem Methods for design where deemed necessary.

The percent retained on a No. 6 sieve, and the percent bitumen are adjusted for each project depending on the type and number of vehicles per day compared with traffic counts of other projects of our experience with mixes of the same constituents. In general, coarser mixes are used on the higher traffic count roads.

The equipment for test and inspection of bituminous concrete is supplied by the Laboratory. The Contractor furnishes a suitable building or work space for the exclusive use of the Departmental Personnel. The area in which the centrifuge is to be operated must be provided with ventilation by an exhaust fan so there is no odor of solvent in the breathing zone of the operator. An exhaust fan of about 1600 cu. ft. per minute is required for this purpose.

The inspector is provided with a bituminous concrete kit, a field sieve set and a field centrifuge by the Laboratory. The bituminous concrete kit contains all of the equipment other than sieve set and centrifuge and the forms necessary for his use.

The plant inspector is generally in charge of the plant inspection forces. His responsibilities are summarized as follows:

To know that the incoming bituminous material and aggregates comply with specification requirements.

To see that the aggregate sizes to be combined in the mix are properly proportioned by the feeder before entering the drier.

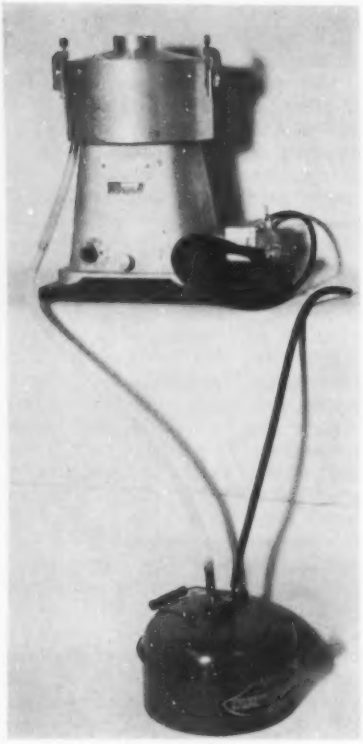
To see that the temperatures in the drier are properly maintained so as to result in the specified mix temperature.

To see that the plant screens perform satisfactorily as measured by the carry-over analysis.

To see that the mixing time and mix temperature are as specified.

He is also responsible in a general way for checking on the work of the field centrifuge operator and the ticket writer.

The plant inspector is required to obtain at least one sample of each size of aggregate used in the mix each day and to check its gradation. Where gravel coarse aggregate is used, the inspector is required to check the percent crushed as well. The results of these tests are entered on the Bituminous Concrete Plant Report. A 5-foot square canvas is included in the bituminous concrete kit to make it possible for the in-



● **FIELD centrifuge with can for waste solvent connected. Glass insert permits observation of flow in tube.**

spector to split down large samples of aggregate and obtain a representative portion for test. Sieving is done with the field sieve set using the coarsest sieve specified for the first separation, the next coarsest sieve, etc. The use of the field sieve set and scale must be coordinated between the plant inspector and field centrifuge operator to permit each to perform his work satisfactorily.

Field Centrifuge Operator

The field centrifuge operator is required to perform a complete mix extraction for each 1½ hours of plant production. The first test is made on a sample taken shortly after beginning of production each day. Due to its relatively high degree of safety, trichloroethylene is used as the solvent in these tests. However, inspectors are instructed that trichloroethylene is not to be used for cleaning of equipment or the person. Stoddard solvent or a similar low toxicity material is supplied for this purpose. Samples of bituminous concrete for the field centrifuge test are obtained from several batches from one or more trucks.

The results of the several field centrifuge tests are listed on the "Bituminous Concrete Plant Report." These reports are mailed to the Laboratory at the end of each day's work.

The ticket writer is responsible for issuing a Bituminous Concrete Plant Ticket for each load of material that complies with Specification requirements. One copy of the Plant Ticket accompanies the load to the work. The second copy is made available to the Contractor and a third copy is retained for Laboratory records. At the end of the day the tonnage record is summarized as shown under the production record of the Bituminous Concrete Plant Report.

Each inspector is provided with a Bituminous Concrete Manual for Plant Inspectors and Centrifuge Operators prepared under the supervision of the head of the Bituminous Concrete Section of the Laboratory. Most of the phases of bituminous concrete plant inspection covered in this article are given in much greater detail in the Manual. The author wishes to acknowledge the contributions to the Manual of his predecessor and his successor as head of the Bituminous Concrete Section as well as contributions of other Laboratory personnel.

Copies of the data sheets and reports mentioned in this article are available at the laboratory and a sample of each can be had on request.

18-Month Exposure to Severe Conditions Tests Protective Coating

TAKE A concentrated portion of humid, saltwater atmosphere; sprinkle frequently with corrosive salt spray; mix well, occasionally adding fly ash and soot; flavor with diluted exhaust fumes from gasoline and diesel engines; and expose to sequences of sunlight, fog and rain. Apply the resulting mixture liberally and consistently on a round-the-clock basis to the ventilation intake louvers of an underwater vehicular tunnel connecting two prominent deep-water ports on the Eastern seaboard.

This is the unusual recipe for about as destructive a set of conditions as can be devised for outdoor architectural metal. Yet, today, after 18 months exposure, the aluminum louvers of the ventilation buildings at Hampton Roads Bridge-Tunnel, Chesapeake Bay, have the same appearance as the day they were installed, with no evidence of oxidation residues or discoloration.

● **ALUMINUM louvers on the ventilation building of the Hampton Roads Bridge Tunnel get severe exposure.**

The preservation of this finish is a combination of anodizing and a clear protective coating which was applied to the louvers by their manufacturer, Construction Specialties, Inc., Cranford, N. J. After fabrication the louvers were anodized with a light grey finish, and then sprayed with a protective butyrate lacquer furnished by the Egyptian Lacquer Company of Kearney, New Jersey. The butyrate film-former, supplied by Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Company, is the ingredient that gives the coating its extremely tough, durable and non-yellowing characteristics.

The Hampton Roads Bridge-Tunnel, created under the Department of Highways, Commonwealth of Virginia, is the key connecting link in a 24-mile highway improvement program for tidewater Virginia. It unites the peninsular cities of Hampton and Newport News with Norfolk and Portsmouth to form an integrated urban area of about one-half million inhabitants. The tunnel and bridge approaches and connecting highways were designed and engineered by Parsons, Brinckerhoff, Hall & Macdonald of New York City.

The two ventilation buildings for the tunnel are located on the portal islands about fifty feet from the water's edge. Fresh air is drawn through the aluminum louvers which cover a 1680 square-foot intake area, circulated through the tunnel and the vitiated air exhausted via stacks on top of the ventilation buildings.

● DEEP excavation for sewer construction. Workmen are protected by the steel shoring and cross bracing.

SAFETY IN SEWER CONSTRUCTION AND MAINTENANCE

LEROY W. VAN KLEECK,

Principal Sanitary Engineer,
Connecticut State
Department of Health

IT IS an axiom that safety is a state of mind; its attainment, a matter of good management. From a study of workmen's compensation insurance rates there is no evidence that any substantial progress has been made in sewage works safety during the past 15 years. Why? The answer is in the following quotation from a portion of the Introduction of the Second Edition of the Federation's Manual of Practice No. 1 on "Safety in Wastewater Works":

". . . . It is apparent that accident prevention programs are not implemented as formal management tools in a majority of American municipalities.

"The absence of effective employee safety and industrial hygiene work in public employment is regrettable. It is anomalous to find the great number of public agencies and municipal corporations today devoting great effort to the promotion of highway, home, and industrial safety—yet these same agencies do not set an example of accident prevention with their own employees."

In all too many local sewage works departments no one is trained to teach safety. In contrast, gas, telephone and electric utilities, and numerous private corporations, have active safety programs for their employees. In big business, safety is big business. In the prevention of accidents nothing can be taken for granted. Those in charge of sewage works must: 1) Study the accident record to see where accidents are occurring, and why; 2) recognize inherent hazards; 3) provide safety equipment; 4) insist on safe practices; and 5) encourage safety-thinking by all employees. Such encouragement can often be supplemented by employee safety committees who bring suggestions to management.

When did you have your last accident? How was it caused?—it didn't just happen! Your own personal experience in the accident field is of value in setting up a sewage works safety program. The introduction of the new Federation's Manual of Practice No. 1 outlines: 1) The responsibilities of management; 2) the importance of reporting accidents; and 3) how to investigate injuries.

And regarding accident causes it must be remembered that certain employees are prone to accidents. Such personnel may work too fast or too slow; they may have poor coordination; even their physical stature (short or tall) may have a bearing on their accident record. Dr. Will Menninger, one of the nation's leading psychiatrists, states that accidents in industry are frequently due to mental problems. Thus, as supervisor, it is apparent that you must also know your men.

Safety in Construction

The Work Area—A study of the general area where construction work will be done prevents many accidents that may otherwise occur. Sound planning at this stage is an accident prevention program. Is the area of work in a business, residential or commercial zone? Will help be needed from the traffic division of the police department? The answer is usually, "yes." Will it be necessary to schedule the work for "off-peak" traffic hours or can the job proceed uninterrupted? Contacts with other utilities having property overhead or underground are of mutual benefit in getting the job done without damage to their property and in preventing hazards to your employees. The safety of the public on foot and in vehicles must be given a high priority. This means adequate barricades, signs and indicated traffic lanes with ample pre-warning, depending on the volume and speed of travel.** And lastly, a foreman trained in safety should be in charge. Such a foreman will see that the right tools are on hand and that safety equipment, emergency telephone numbers and first-aid treatment are readily available.

Moving Work Equipment—If the foreman and equipment operators stay with work equipment in transit from the yard to the job, this insures that all equipment and personnel will arrive on the job together by the safest and best route. Machines on trailers can also be watched, by those in responsible charge, for faulty blocking or locking.

Excavations—Excavations are the major inherent hazard in sewer

*Federation of Sewage & Industrial Wastes Associations.

**"Work Area Protection" by Gordon L. Smith, *Sewage & Industrial Wastes*, December 1958, page 1518.

● "PERMISSIBLE" lamp cap for sewer workers leaves both hands free.

● SAFETY belt should be used in deep manholes or in industrial areas.

● WHEN required by emergency, air demand-type mask safeguards workman.

construction work. The following measures aid materially in avoiding the most frequent causes of accidents to both workers and the public:

1) The earth removed from trenches and holes is piled away from the immediate area of excavation to avoid added pressure on the vertical sides which might otherwise cause a cave-in.

2) All deep trenches are given adequate bracing with wooden or metal shoring, depending on the type of soil and its water content, and the depth of the excavation. There should be no hesitation in seeking expert advice in questionable cases—the collapse of excavations with burial of workers has occurred frequently.

3) Sand or salt or both are spread immediately in the bottom of the excavation and on the ground surface in the vicinity of the work area whenever ice, snow or slippery mud is encountered.

4) Good housekeeping is rigidly enforced. This means removal of protruding nails in boards, the stacking of surplus timber in a segregated area to prevent workers or the public from tripping over it, and the storage of tools and other equipment, such as pumps, in designated protected areas.

5) The possibility of oxygen deficiency in deep trenches, holes or empty sewers is always realized and tests for oxygen deficiency and adequate forced ventilation are employed as required.

Men have died in empty excavations, manholes and sewers where neither sewage nor foreign gases were present, as a result of insufficient oxygen to support life. Oxygen depletion in such cases may occur from poor ventilation or the oxygen in the air may be depleted by absorption or chemical consumption as a result of bacterial action between the oxygen and the organic matter present in certain soils. This bacterial action replaces the oxygen with carbon dioxide and nitrogen, neither of which will support life.

● SHOE guard or safety shoes are used to prevent injuries to the feet.

Photos this page courtesy Mine Safety Appliances Co.

● COMBUSTIBLE gas indicator is used to check the hazards of explosion.

The ever-present threat of oxygen-deficiency in deep structures cannot be over-emphasized.

Handling Pipe—Heavy pipe should be unloaded and placed by machinery. Sprains or more serious injuries occur frequently to the hands, feet or backs of workers when manpower is used. When chain or rope slings are used with cranes or other mechanical lifting equipment, they should be of adequate strength and properly attached to the pipe to prevent slippage. Workers should keep clear of all pipes suspended in the air. Pipe stored in piles attracts children as an area for play. To minimize the possibility of physical injuries to children the pipe can be laid in individual lengths flat on the ground or strapped or blocked securely when laid in piles.

Protective Apparel — Protective equipment and garments help to reduce personnel accidents. When a hazard exists and it cannot be removed mechanically, protective apparel is a secondary means of worker protection. The following list is indicative of equipment available:

1) Hard protective hats to guard against head injuries from falling objects.

2) Goggles or masks, which will protect the eyes from flying objects and sparks, when grinding, welding or jack-hammer work is in progress.

3) Protective creams for the skin when workers are exposed to greases, paints or dusts.

4) Respiratory protective apparatus when oxygen deficiency or noxious gases are present and an emergency exists. Unless an emergency exists, the atmosphere should be made safe for workers by ventilation and/or removal of the cause of an unsafe atmosphere.

5) Natural and synthetic rubber or composition sleeves, gloves, leggings, coats or complete coverall clothing for protection against bruises, electrocution, the weather or atmospheric contamination.

6) Safety shoes or toe guards for the prevention of foot injuries from falling objects. Non-conducting soles are available also with some safety shoe models to guard against electrical conductivity.

7) Safety belts for removing an injured or asphyxiated worker from an underground structure. They are also useful for lowering a man safely through a confined shaft, in providing a steady support while he works, or for checking a fall while he descends into an excavation.

Clean-Up—When the job is done, clean-up of all debris is not only a good safety measure but it promotes good public relations. The area should be leveled off, torn-up lawns regraded and seeded and the street hosed. A good rule is to leave the area better than you found it.

Safety in Maintenance

Preventing Physical Injuries—Protection to both sewer workers and the public requires, as in sewer construction work, adequate barricades, signs and indicated traffic lanes whenever sewer manholes are open and maintenance equipment is in use in thoroughfares. Adequate illumination at the top of manholes and in sewers is a necessity. Illumination can be obtained with glass reflecting mirrors, portable explosion-proof electric lamps or "permissible" electric cap lamps. Many physical injuries are avoided by good illumination.

When workers are in manholes deeper than 10 feet, especially those over large sewers or sewers serving industrial areas, they should wear safety belts and at least two men should be available for lifting workers from a manhole in case of injury. Many of the lives formerly lost in sewers could have been saved by this simple expedient, especially where asphyxiation was the cause of death.

Protective apparel, as discussed under *Sewer Construction* is also often desirable for sewer maintenance workers.

Prevention of Infections—Prompt first-aid treatment of all cuts, burns and wounds, no matter how small, is mandatory. Protective apparel keeps the body free of contaminants. While at work, sewer maintenance men should refrain from smoking, and keep their fingers out of the nose, mouth and eyes. After work and before eating or smoking, the hands should be washed thoroughly with plenty of soap and hot water. Inoculations for typhoid and tetanus are highly desirable.

Gases and Oxygen Deficiency—Before workers enter deep manholes, pits or tanks the following tests of the atmosphere should be made:

1) A test for flammable or explosive gases or vapors, using a portable combustible gas indicator.

2) A test for hydrogen sulphide gas with hydrogen sulphide ampoules or a hydrogen sulphide detector.

3) A test for carbon monoxide gas, if manufactured illuminating gas leakage is possible, with carbon monoxide ampoules or a carbon monoxide detector.

4) A test for oxygen deficiency, using an oxygen deficiency indicator (not a safety lamp).

5) Observations of any foreign odor or irritation to the eyes.

It is common practice to make these tests at a depth about 6 feet above the manhole floor, this representing the working height. Gases lighter than air and which are present at higher levels in the manhole, will be vented after removal of the cover. If, however, flammable gases are detected near the bottom of manholes, it is wise to test throughout the depth of the manhole shaft.

If the depth of a manhole is known, it is desirable to lower the sampling hose or testing equipment through a ventilating hole in the undisturbed manhole cover, or the cover may be cracked open slightly, care being taken to avoid a spark.

The Federation's Manual of Practice No. 1 gives further details on the procedures to follow, describes the above equipment and its use, and explains the characteristics of all the common gases encountered.

If noxious gases, or oxygen deficiency are found, thorough ventilation by natural or artificial means is mandatory. Ventilation may be secured with canvas canopies over opened adjacent manholes (provided a good wind is blowing), with

● **SAFETY precautions must be continued until final completion of a sewer construction project. Traffic control protects workmen during this backfill operation.**

a water stream from a fire hose, with compressed air from a portable air compressor or with portable air blowers. Following ventilation, the atmosphere is re-checked by testing before workmen enter the structure.

If an emergency exists and men must enter an unsafe atmosphere, extreme precautions are necessary. No foreman should ever send workmen into such an atmosphere unless he is fully aware of the dangers and precautions needed. These precautions are:

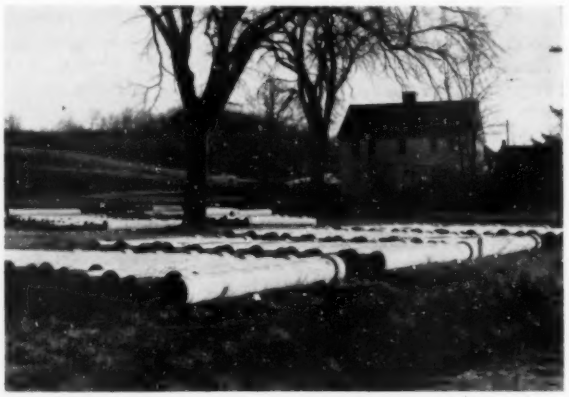
1) No smoking, open lights or sparks. Non-sparking shoe soles must be worn or rubbers. Only "permissible" explosion-proof safety lighting can be used. If tools are required, they must be of non-sparking beryllium-copper alloy; 2) safety belts must be donned; and 3) protective respiratory apparatus must be worn. Either compressed air (*not oxygen*) demand-type masks or hose masks may be used. No other type of respiratory apparatus is recommended in such situations.

It is re-emphasized that work in noxious gas or oxygen deficient atmospheres, particularly flammable gas atmospheres, is extremely hazardous and should be entirely avoided except in emergencies.

If a worker is overcome in a sewer from noxious gases or oxygen deficiency as a result of failure to pre-check the atmosphere, artificial respiration (resuscitation) must be started at once. All sewer foremen should train their men in the back-pressure arm-lift (Nielson) method of manual artificial respiration. The procedure is given in detail in the Federation's Manual. Inhalators are valuable adjuncts in resuscitation work and should be readily available.

Mouth-to-mouth resuscitation is recommended when the chest, arms, or shoulders are injured and might be further damaged by the back-pressure arm-lift method. Controlled tests indicate in fact that mouth-to-mouth resuscitation is superior to all former methods. The steps of the mouth-to-mouth method are given in the latest edition of the American National Red Cross' "First Aid Textbook;" additional information is also given in the Federation Manual.

● **METAL strap secures sewer pipe stack against slippage and breakage. Unprotected stack at rear represents a hazard.**



● **PIPE storage areas are attractive playgrounds. Individual lengths should be laid flat on the ground where space permits.**

Basic Principles for Direction Signs

The matter of uniformity in signing on the California freeway system, so that the motorist will get where he is going without making the wrong turn, was discussed before the American Society of Civil Engineers at its convention in Los Angeles.

G. M. Webb, of Sacramento, Traffic Engineer of the California Division of Highways, presented to the engineers the results of a research project on "Driver Needs in Freeway Signing," conducted for the highway division by the Automotive Safety Foundation.

Mr. Webb reported that there was a "conviction," induced by the analysis, that the freeway user can be served best by signing designed to fit individual conditions at each location encountered by the motorist; and, further, that the design of such signing should be governed by a few basic principles. It was noted that, by definition, uniformity means treating similar situations similarly. Hence, different, novel and unique situations must be treated individually.

The report indicated six basic principles that are broadly applicable to directional signing generally. These are:

1) Interpretation—Possible interpretations and misinterpretations must be considered in phrasing sign messages (words and symbols). Messages must be complete and clearly stated. Cryptic messages, which are easily misinterpreted, must be avoided.

2) Continuity—Each sign must be designed in context with those which precede it so that continuity is achieved through relatively long sections of highway. The driver should be expected to evaluate not more than one new alternative at any advance sign.

3) Advance Notice—Signing must prepare the driver ahead of time for each decision he has to make. One sign far in advance is enough, if he sees it, but in dense traffic the driver's chances of completely missing a message are great. Advance notice must be repeated.

4) Relatability — Sign messages should be in the same terms as information available to the driver from other sources, such as maps, and addresses given in tourist information and advertising.

5) Size—The size of a sign or message should be related to the competition from other demands on the driver's attention. These demands include other visual aids, signs and parts of the message, and the task of driving.

6) Unusual Maneuvers — Signing must be specifically designed at points where the driver has to make a movement which is unexpected or unnatural. The driver's natural inclination to turn a certain way will frequently lead him astray.

● AERIAL view shows how water (mainly sewage plant effluent) was pumped upstream to supply Lyndon's water plant.

THE RE-USE OF TREATED WASTE WATER *FOR DOMESTIC PURPOSES*

DWIGHT F. METZLER,

Chief Engineer,
Kansas State Board of Health

This paper was presented before the Engineering and Sanitation Section, APHA, and the Conference of Municipal Public Health Engineers in October, 1958, at St. Louis, Mo.

ALTHOUGH treated wastes are being utilized increasingly to supplement industrial and agricultural water supplies, any proposal to reuse waste waters for domestic purposes brings loud cries of protest, some based on fact and some on emotion. Those who object upon esthetic grounds often do so on the basis of time—on how recently some of the water was contaminated by wastes. Citizens frequently object to rivers as a source of public water supply if a nearby city is discharging treated wastes upstream. This was the case at Dallas when it elected in 1956 to ignore water of good chemical quality in the Trinity River at its very doorstep and go many miles to the Red River for water of poor chemical quality, because the treated wastes from Fort Worth flow into the Trinity River upstream. Much less objection is voiced when the upstream city is some distance away. Few persons are concerned that some of the water they are drinking may in ages past have gone through the intestines of dinosaurs or other mammals before it came to their lips.

Industrial Reuse

Twenty-five years ago N. T. Veatch designed a sewage treatment plant for Herington, Kansas, which would treat the city sewage to meet the needs of the Rock Island Railroad for boiler water. Until the demise of the steam engine, revenue from the railroad paid the operating costs of the treatment plant plus a large part of the fixed costs.[1] Some 10 years earlier a small activated sludge plant with chlorination was built at Grand Canyon National Park, Arizona, to treat the wastes from the hotel for reuse for sanitary purposes and cooling water at the power plant.

More recently, large water reuse projects such as those for the Cosden Refinery at Big Spring, Texas; the Kaiser Steel Plant at Fontana, California; the Sun Oil Company Refinery at Toledo; and the Bethlehem Steel Company at Baltimore have attracted wide attention.[2] But in a quiet, unpublicized manner, numerous industries have separated their waste streams to permit recycling, have used water of inferior quality instead of drinking water, and have provided treatment which runs the full gamut of sanitary and chemical engineering knowledge so the waste waters could be reused. In general, these programs have helped public health since they have reduced the pollution load on many streams because the removal of pollutants by chemical treatment, stripping or burning was necessary for continued reuse.

Bacteriological and Biological Quality

The use of streams receiving sewage effluents as a source of water supply is not unusual. Some large midwestern cities depend upon the Missouri River for a source of supply, even though essentially none of the sewage is treated below Yankton, S. D., to the junction of the Missouri and Mississippi Rivers at St. Louis. The large volumes of dilution water may explain the lack of concern by cities of this pollution of their water supply source, although materials of recognizable sewage origin collect upon intake structures and float in sedimentation basins.

Along 260 miles of the Neosho River in Kansas, 13 cities take raw water, use it and discharge treated

wastes to the stream. During drouth periods the flow at each waterworks intake approximates the treated sewage from the upstream city. The bacterial quality of the treated water has been good at each city, and the residents have little prejudice against the use of the water.

Two cases of interest have occurred in Kansas. Lyndon, a town of 840, had been on short water rations in 1954 and 1955, and in the fall of 1956 its supply from Salt Creek was exhausted. All of the water upstream had been pumped over riffles to the water purification plant, which consisted of a pumping station, two chemical mixing chambers, a settling basin, rapid sand filters, and a clear well, with high lift pumps and an elevated tank floating on the system. Water normally stored in two upstream impoundments had been exhausted and the supply behind the overflow dam at the water intake was being rapidly depleted. The only remaining water was in the pools below the sewage treatment plant. This water had been stored an estimated period of from a few to 60 days after leaving a standard rate trickling filter.

The second pool below the treated sewage outfall was first pumped upstream to above the overflow dam. This water was replaced as the city's treated sewage continued to flow into the creek. The decision was then made to pump water upstream from that reach of the stream immediately below the sewage treatment plant as well as from the lower pool. Water from the upstream point had an MPN of 230,000 coliforms per 100 ml.

Portable chlorination facilities were set up to treat the water as it was pumped. Twenty-two mg/L of chlorine gave a small free residual as the water was pumped upstream to the water supply impoundment. Samples of the pumped raw water were dechlorinated immediately and at 15 and 30-minute intervals, and all were free of coliforms. Daily samples of raw water pumped from the reservoir gave counts from zero to 93 per 100 ml. Algae grew prolifically in the raw water, but no serious taste and odor problems occurred.

Chanute, a Kansas city of 12,000, exhausted its water supply in October, 1956, and without publicity built an earth dam below the sewage plant outfall to back treated sewage upstream a mile to the waterworks intake. About 20 days' storage was provided for some 20-25 million gallons. When the State Board of Health discovered this innovation in December, it insisted on chlorination of the treated sewage and additional chlorination at the water plant. Coliforms in the river are normally in the range of 1000 to 10,000 per 100 ml, but during the period of recirculation with chlorination at the sewage treatment plant the range was 10 to 70. During the 5-month period of recirculation only one of 560 ten-ml tubes of treated water was positive for coliforms. On the basis of the coliform index, the water was of good bacteriological quality the entire time.

Concern that standard bacteriological techniques might not provide adequate indices of the safety of the treated water led to a series of special studies to isolate virus by the Robert A. Taft Sanitary Engineering Center. Some 60 virus agents which are pathogenic to man have been isolated from human feces. Those recognized as disease-producing include poliomyelitis, infectious hepatitis, and perhaps Coxsackie and the adenoviruses. The studies were undertaken because of the dearth of knowledge about the efficiency of standard water purification techniques in removing or inactivating virus in the raw water. The apparent water-borne outbreak of infectious hepatitis in New Delhi the year before had heightened concern.[3] While two positive virus isolations were made from the treated sewage at Chanute, some 38 other samples were negative, including all of the raw and treated water.[4]

In spite of relatively low temperatures, the growth of algae in the river channel was stimulated by the enrichment of the water. Algal counts varied from 2,000 to 45,000 per ml, and the water treatment plant gave removals as low as 80 percent. The average removal for the period was about 90 percent. The low removal efficiency of the water plant was caused, in part at least, by inadequate filter backwashing, and only fair laboratory control of coagulation. The inadequacy of the filters was emphasized by the finding of particulate matter in the 5-20 micron size range in the finished water.

No planned morbidity studies were made at either Lyndon or Chanute, although the physicians were aware of the water reuse and alert to any cases of water-borne disease. None occurred; in fact local physicians reported that there were more intestinal disturbances a year later when the source of water supply had returned to normal.

Chemical Quality

Because the water at Lyndon was reused only twice, this occurrence provides much less information about the degradation of chemical quality which occurred than at

● **FOAM covering settling tanks of Chanute water plant was produced by agitation of re-used water in recarbonation basin.**

● **AFTER rains had started river flow in March of 1957, the settling tanks of the Chanute water plant returned to normal.**

Chanute. The degradation was slight with an increase in detergents and nitrogen compounds.

Estimates of the number of times water was reused at Chanute vary from 8 to 15. During the period of reuse, the chemical quality steadily deteriorated. Part of this deterioration was caused by the escape of brine from nearby leases where secondary recovery of oil by waterflooding was practiced. The chlorides increased from 190 to 670 mg/L. Of special health significance to those on restricted sodium intake was the increase from 45 to 380 mg/L of sodium. The chemical deterioration of the raw water was further indicated by an increase in nitrogen, alkyl benzene sulfonate (ABS) and total and ortho-phosphates. The chemical and biochemical oxygen demands also increased. When the raw water was at its worst, it contained 17 mg/L of nitrogen, 5.8 mg/L of ABS, and had a BOD of 13 mg/L.

The increase in sulfate concentration from tap water to treated sewage was 26 mg/L. The total solids in the Chanute supply normally range from 200 to 500 mg/L, but during the period of reuse they increased to 1200 mg/L. Chlorination proved to be one of the problems because of the high ammonia concentrations. Free residuals were not attempted because much of the time breakpoint was in the range of 80 to 130 mg/L. False readings were obtained with the conventional OTA test.

The carbon filter technique was used in studying samples of the tap water. The most highly odorous materials are usually shown by the chloroform extractable fraction. Table 1, adapted from data previously reported,[4] compares the extracts with those from clean, moderately polluted and heavily polluted water.

The physical quality of the water at Lyndon was normal, except that the algae were more numerous. The raw water at Chanute did not appear to be objectionable except for the frothing from detergents. However, the treated water eventually had a slight yellow color and a musty, slick taste. The maximum threshold odor number in the treated water was 16. The high ABS content caused frothing when water was drawn from the tap.

● **TEMPORARY dam was constructed below the sewage plant outfall to back up treated sewage until it reached the intake of the Chanute, Kansas, water plant.**

Potentials of Treatment Methods

The Chanute sewage treatment plant depends upon trickling filters loaded at 800 lbs. of BOD/acre-ft/day for secondary treatment. During the period of water reuse, it removed an average of 86 percent of the BOD and 76 percent of the COD. It reduced alkyl benzene sulfonate an average of 25 percent and the complex phosphates by 67 percent. Total nitrogen was reduced 55 percent to an average of 34 mg/L.

Chlorination of treated sewage was an important part of the waste treatment process; it caused a 10-fold reduction of coliforms at the waterworks intake.

The mile-long pond in the river channel detained the treated sewage for about 20 days. Its efficiency in reducing the coliform organisms was not determined, but it reduced the applied BOD and COD by 75 percent. The ABS reduction exceeded 50 percent and the total and ammonia nitrogen reductions were more than 55 percent. The average reduction of 32 mg/L of sulfates, from 111 mg/L to 79 mg/L, as the treated sewage passed through the pond, must have been caused by anaerobic decomposition.

Storage of the treated waste seems to be the most important part of the waste treatment process to assure substantial reductions in sulfates, ABS and ammonia. The estimated 20-25 days storage is not enough, if reuse is to be long continued. Experience in Kansas has shown that 60 to 180 days storage gives excellent ammonia reductions. The longer storage would also permit more breakdown of the detergents and give a larger factor of safety through bacterial dieaway.

On the basis of the Chanute ex-

(*Continued on page* 208)

Table 1—Organic Compounds Recovered by Carbon Filter Method

		Average Organics Recovered		
	Pollution	*Chloroform Extract*	*Alcohol Extract*	*Total Extract*
Source	*Characteristic*	*mg/L*	*mg/L*	*mg/L*
Neosho River at Chanute	Reuse	167	689	857
Columbia River	Unpolluted	33	87	120
Detroit River	Moderate pollution	201	264	465
Merrimack River	Heavy pollution	322	421	743

100-LANE EXPRESSWAY FOR

LEO SANDS
Author of the
"Guide to Mobile Radio"

MORE THAN 100 radiotelephone channels have been made available to what is known as the Local Government Radio Service by the Federal Communications Commission. This means that a 100-lane expressway is now ready for public works communications traffic. Heretofore, various local governmental agencies have had to license radio systems as part of a police or fire system or in the previously congested Citizens radio service. The FCC has made a very generous gesture in making so many channels available for vital, local use.

Contractors and other non-governmental participants in public works projects have some 180 radiotelephone channels which can be used when radio stations are licensed in the Business radio service. And, in addition, there are 91 channels available in the Citizens radio service, which is open to any citizen of the United States over 18 years of age, whether a corporation, an association, an individual or a local governmental agency.

Mobile radio equipment is now being purchased at the rate of $95,000,000 per year according to industry experts. Two-way ra lio has been available for more than a decade and the impact of its value as a time and money saver is finally being felt. Since its reliability has been well demonstrated and its economic value is no longer questioned, two-way radio is being applied wherever rapid communication will facilitate operations and add to safety and convenience.

In many public works applications, only short-range communication is required. Gangs will soon be able to keep in touch with each other by radio with a new all-transistor pocket-size two-way radiotelephone which is being readied for the market. It will sell for under $100.

These low-priced, low-power radiotelephones will talk about five miles. They will talk much further, even up to 20 miles, when the office station antenna is placed high above surrounding trees. Car-to-car communication, however, may be limited to about a mile or so and even less for the small pocket rigs.

When greater range is required, the higher-powered radiotelephones should be used. These cost from about $450 up for a unit to be installed on a vehicle and as much as $2000 for the office station.

Mobile radio equipment is made by several manufacturers, some selling direct from the factory to the user, others selling through local dealers. Large firms like Tele-Dynamics and Federal Electric Corp., the service organization of International Telephone and Telegraph Corp., which do not manufacture radiotelephones sell (or lease), install and service mobile telephone equipment, offering the customer a complete package which includes all of the accessories and appurtenances plus maintenance.

Three Bands Available

The public works user of two-way radio has a wide choice in equipment as well as in operating frequency. Channels are available in what are known as the low band (25-50 megacycles), the high band (152-174 megacycles) and the ultra-high band (450-470 megacycles). Greatest range is generally achieved in the low band (as much as 50-60 miles) but there may be a little more noise than in the other bands and sometimes, especially at night, interference from other radio stations hundreds of miles away may occur due to what is known as "skip interference."

● **DIAL sender permits driver to signal directly to other vehicle or offices.**

While the low band is often used for regional or county-wide coverage, the high band is generally used for coverage of a metropolitan area. The ultrahigh band is reputed to have about two-thirds as much range as the high band but this is not always true. In fact, a system operating on this band in heavily wooded Skagit county in Washington

● **DIAL CODE sender, left, provides for signaling any vehicle or gang without alerting others. Radio unit at right can be used on vehicles or in central office.**

Public Works COMMUNICATIONS

● **TWO-WAY radio permits supervisors to coordinate the work of the various gangs and pieces of equipment and to keep in touch with all phases of the work all the time.**

state, provides 65-mile range between trucks and home base.

Communicating range depends most on the effective elevation of the antennas of two stations that are in communication with each other, and to a lesser extent on the power of the radio transmitter. At these high radio frequencies (short waves), the radio signals travel essentially over a line-of-sight path. However, it is not necessary to be able to see from one station to another to have communication. The signals, which act like light, are reflected by solid objects. The reflection characteristics are more pronounced when operating on the high and ultrahigh bands than on the low band.

It is because of the reflection characteristics that communication is possible with vehicles traversing city streets where large buildings intervene between the office station and the vehicle. Trees, on the other hand, absorb these radio signals and detract from the range. In mountainous areas, the signals are bounced off the walls of canyons. On the Milwaukee railroad, for example, in the state of Washington, communication between a way station and trains was intermittent until a directional antenna, which beams the signal, was used and pointed, not down the track, but at the wall of a canyon. The signals were bounced off the canyon wall down to the tracks along the winding right-of-way.

While an ordinary auto radio used for listening to AM broadcast programs generally ceases functioning when the vehicle enters a bridge with a steel overhead structure, or a tunnel, mobile radio communication often continues. This is because the signals are reflected by the metal. In long tunnels, however, communication may not be possible except near the entrances. Locomotives operating at Union Station in Washington, for example, could keep in radio contact with the tower while inside the tunnel under the depot wherever the overhead catenary extended, but ceased when the engines went deeper into the tunnel where there were no overhead catenaries.

The tests at the Washington railroad station were conducted with radio equipment operating in the high band. Tests were made later in the Lincoln tunnel which links New York City with New Jersey using equipment operating in the ultrahigh band. It was found that two radio-equipped cars could maintain radio contact with each other for at least half a mile, even with both vehicles inside the underwater tube. Here again, the radio signals were reflected from the tunnel walls.

● **WALKIE-TALKIE is widely useful because it can be used on a vehicle, or it can be carried from place to place or it can be operated from any desired fixed point.**

Transmitter Power

Transmitter power is important where a system is required to cover a rather large area in heavily wooded terrain or where other radio systems are operating on the same frequency in the same general vicinity. When FM equipment is used, the strongest signal captures the signal and the weaker one is not heard. The strongest signal may be from a nearby low power transmitter or a more distant, higher powered transmitter. When AM sets are used, the capture effect does not occur but two or more signals might be heard at the same time.

The lower-priced radiotelephones employ lower powered transmitters than the more expensive variety. The radiotelephones in the $100 class are mostly rated at five watts

(power input to the final radio frequency amplifier stage, as defined by the FCC) whereas bigger sets may be rated as high as 200 watts.

High power is a requirement when coverage of an entire county or metropolitan area with few or no dead spots, is wanted. Low power will suffice when communication with a two to five-mile radius will suffice.

Mobile System

A mobile radio system may consist of one or more base stations and one or more mobile units; or it may consist of mobile units only. A base station is a radio station installed at a fixed location on a temporary or permanent basis which is used primarily for communicating with mobile units. A mobile unit is a radio station installed on any kind of vehicle and is also the FCC designation for a hand-carried radio such as a walkie-talkie.

● **MOUNTING offers few problems. In this case, radiotelephone was placed under front seat, loudspeaker on the dash.**

The communicating range between a base station and mobile units is governed by the effective elevation of the base station antenna and to a lesser extent by the power of the base station transmitter. Effective elevation means more than merely "height above the ground." While an antenna may be mounted on top of a 100-foot mast, it may be located in a natural bowl in a valley surrounded by hills forming a barrier which reduces the range. Effective elevation, therefore, is the height of the antenna with respect to its surroundings.

To gain maximum range, the base station antenna is installed as high as possible. The support may be a steel tower or wooden pole set into the ground. Or, it may be a tall building. Sometimes, the antenna and the base station transmitter and receiver are installed on a hilltop in order to obtain the greatest effective antenna elevation. The radio station, in such cases, may be controlled from another point which can be many miles away, utilizing a leased telephone line or a radio link for interconnection of the control equipment and the radio station.

Radio stations licensed as class B or D Citizens radio stations cannot place their antennas more than 20 feet above the surface or structure on which the antenna support is mounted. For instance, a 20-foot pole set in the ground may be used. Or, a 20-foot pole may be put on top of a tall building or mountain top in order to gain greater effective antenna elevation. This restriction does not apply, however, to radio stations licensed as class A Citizens radio stations or in the Local Government radio service.

The radio equipment is connected to the antenna through a coaxial cable. Ordinarily, the receiver is connected to the antenna. When transmitting, a relay within the equipment switches the antenna to the transmitter.

A mobile unit is similar to a base station except that it is generally designed to operate from the vehicle battery or a self-contained battery. The controls, which consist of a volume control, on-off switch, squelch control and radio-on and transmitter-on indicator lights, may be an integral part of a radiotelephone designed for installation under the dash of a vehicle. When the radio unit is installed in the trunk of a vehicle or in a weatherproof enclosure, a separate control head is generally used and is mounted under the dash.

There is a choice of a hand-held microphone or a telephone-type handset. The microphone is most widely used, but railroads prefer the handset since it enables users to hear radio messages better when in noisy areas. A pushbutton is built into the microphone or handset which is pushed when transmitting and released when listening. A loudspeaker is provided for listening.

In all except the very lowest priced sets, a squelch is provided. Squelch is an electronic circuit which mutes the loudspeaker at all times except when a radio signal is being received. Otherwise, there is a continuous roar coming from the loudspeaker when no radio signals are being received. A knob is provided which the user adjusts. It can be set so that it will not permit reception of radio signals unless they are of predetermined strength. Thus, messages from other radio stations operating in another town or electrical interference can be prevented from "tripping the squelch."

Conventional mobile radio units are available in under-dash or trunk-mounted types. They cost from $360 to more than $800, depending upon their power rating and band of operation. Portable sets or low-power mobile units are available in the $100-$360 class. A portable may be one that is intended for toting from one vehicle or fixed location to another or it may be a walkie-talkie or belt-type set. The larger ones are intended for operation from a vehicle battery while the smaller portables derive power from a self-contained battery. Some will also operate from 115 volts a-c so they can be used in a building, on a vehicle or in the field.

Low Cost Systems

For an investment of $100-$175 each, radio equipment can be obtained that can be used at offices, in the field and on vehicles for providing communication within a one-to-five mile range. These sets are customarily provided with a plug-in antenna which suffices for minimum range between vehicles and between men in the field. When a radiotelephone is installed in an office and a 20-foot high external antenna is used, vehicles and men in the field provided with 5-watt portables can talk with personnel at the office within a five-mile radius. This range will vary, of course, depending upon the nature of the terrain.

These sets can also be used for point-to-point communication. One, for example, may be installed at the main office and another at a field office. If both have external antennas on 20-foot masts, communication between two offices ten or more miles apart can often be achieved. Again, it depends upon trees, obstructions and antenna elevation.

The new all-transistor pocket-size portable radiotelephone, belt-type sets and walkie-talkies are generally useful for communicating with one another over ranges of less than one mile. However, when they are used for communicating with a higher-powered base station or mobile unit, the range can be considerably more.

When conventional mobile units rated at 10 watts or more are used, mobile-to-mobile range of from 3 to 5 miles is about par for the course. Communication with a base station whose antenna is way up in the clear is provided within a range which can vary from 10 to 50 miles

or more, depending upon surroundings.

Car-to-car, portable-to-portable and car-to-portable range can be drastically increased by employing a mobile relay station whose two antennas are up high. A relay station consists of a receiver and a transmitter, each with its own antenna. The receiver picks up signals from portables and mobiles and then retransmits the intelligence on another channel. Communication between two vehicles can be increased to 30 miles or more, depending upon the effective elevation of the relay station antennas. Equipment for a relay station costs from as little as $589 to more than $2000, depending upon requirements.

● **RADIOTELEPHONE is available with either 12-volt dc or 115-volt ac built-in power supply. Range is 5 to 20 miles.**

Licensing

The low-power, low-cost ($100-$175 class) radiotelephones are mostly acceptable by the FCC for licensing only as class B or class D Citizens radio stations. A more expensive unit, the Kaar IMP, for example, has been type-accepted by the FCC for licensing as a class D Citizens radio station as well as in the Local Government, Business and other land mobile radio services. Higher-priced sets for use in the ultrahigh band can be licensed as class A Citizens radio stations or in the Local Government and other land mobile radio services. Conventional mobile radiotelephones for the low and high bands must be licensed in the Local Government, Business or Special Industrial radio service for public works applications, depending upon whether the licensee is a governmental body or a private contractor.

Licenses are free. They are obtained by filing a written application with the Federal Communications Commission in Washington using appropriate forms which are available from the FCC or from a radiotelephone equipment manufacturer. The firm selling the equipment generally assists his customer in preparing the license application.

In the Citizens radio service, operator licenses are not required. In other land mobile radio services, the operator of the base station must possess a restricted radiotelephone, operator permit. The permit is free and the applicant does not have to take a test.

Maintenance

Of course, like any electronic device or piece of machinery, radiotelephone equipment requires maintenance. Most of this work is handled by private outside contractors or by licensed personnel employed by the department. If done internally, the technician must be provided with suitable test equipment which will cost at least $1000. Private contractors, of course, furnish their own test equipment.

Choice of the band which will provide optimum performance should be left to an expert who can best determine which of the three bands is best suited for a particular application. If an expert is not available locally, an outside consultant's services should be utilized. Most communities have a radio engineer in charge of the local police radio system who can be looked to for counsel.

However, it is a good idea to get advice from unbiased sources. Most sales engineers who sell mobile radio equipment are well versed in the art and have technical competence. But, they do want to sell their own brand of equipment and in the case of competitive bidding, hope at least to influence the specification writer to favor his equipment.

A good specification can be written, which will let several manufacturers bid without requiring taking of exceptions. The specification need not be written so that it specifies certain types of tubes, filters or other components of a proprietary nature. The specification can simply state the kind of performance and range required, the environment to which the equipment will be exposed, the nature of the available electrical power supply, etc. Unless one has had experience writing a specification for this kind of equipment, assistance from a qualified, unbiased consultant should be sought.

General information about mobile radio systems may be obtained from a new book "Guide to Mobile Radio" published by Gernsback Library, Inc. Your local radio parts distributor either has it in stock or he or a book dealer can order a copy for you.

Information about various makes and types of mobile radio equipment is available from any of the several manufacturers and distributors that are listed herewith.

MANUFACTURERS AND DISTRIBUTORS OF MOBILE RADIO EQUIPMENT

Bendix Radio
Towson 4, Md.

Communications Co., Inc.
Coral Gables, Fla.

Allen B. DuMont Laboratories, Inc.
Clifton, N. J.

Federal Electric Corp.
Paramus, N. J.

General Electric Co.
Lynchburg, Va.

Industrial Radio Corp.
428 N. Parkside
Chicago 44, Ill.

International Crystal Mfg. Co.
18 N. Lee Ave.
Oklahoma City 1, Okla.

Kaar Engineering Corp.
2995 Middlefield Road
Palo Alto, Calif.

Lenkurt Electric Co.
San Carlos, Calif.

Link-by-Gonset
801 Main Street
Burbank, Calif.

Morrow Radio Mfg. Co.
Salem, Ore.

Motorola Communications & Electronics
Chicago 51, Ill.

Pye Corp. of America
Highland Park, N. J.

Radio Corporation of America
Camden 2, N. J.

Robert Dollar Co.
50 Drumm St.
San Francisco, Calif.

Tele-Dynamics
51st and Parkside
Philadelphia, Penna.

Vocaline Co. of America, Inc.
Old Saybrook, Conn.

THE SANITARY ENGINEER AND

EDMUND B. BESSELIEVRE, P. E.
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WHEN the management of an industrial plant is faced with an order to treat its liquid wastes, three questions immediately arise: 1) What do we have to do? 2) Who can tell us how to do it? 3) How much will it cost? The first and third questions can be best answered by the engineer selected as the answer to the second.

The treatment of liquid industrial wastes is, in the majority of cases, expensive for the plant producing them. In a competitive market no industrialist has any desire to increase his costs of production. Therefore, his first concern should be to engage a specialist to handle and solve his problem. If he relies on his own people or does not pick a skilled consultant, he may send a lot of good money down the drain in experiments and unnecessarily costly plant and equipment. The junkyards of many industrial plants are cluttered with the discarded results of unwise ideas.

Who is the specialist best qualified to do the job? In my opinion, it is the consulting sanitary engineer, free of inhibitions, free of prejudices and with no leanings toward any specific methods or processes, equipment or apparatus.

Why is the consulting sanitary engineer best qualified for this class of work? The following are a few of the reasons:

1) He is accustomed to dealing with the staffs and engineers of the various regulatory agencies. He knows their attitudes, their basic thinking for the job they are engaged to do. Because he has been trained in the art and science of preventing stream pollution by municipal sewage, he knows the aims of these agencies.

2) The rules and regulations of the agencies are usually generalizations intended for an over-all average condition. The sanitary engineer is accustomed to evaluation of these regulations in the light of the problems of his clients and is best qualified to determine whether the specific requirements are logical, necessary or expedient for the case in hand. Because he knows, and the agencies know that he knows, he usually can get a better end requirement for his client.

Courtesy Dorr-Oliver Inc.

● **TREATMENT for meat packing wastes by 28-ft. Duo-Clarigester, foreground, and 45-ft. Duo-Filter in background. Plant covers area 80 by 100 ft. PE is about 3,000.**

Courtesy Walker Process Equip. Co.

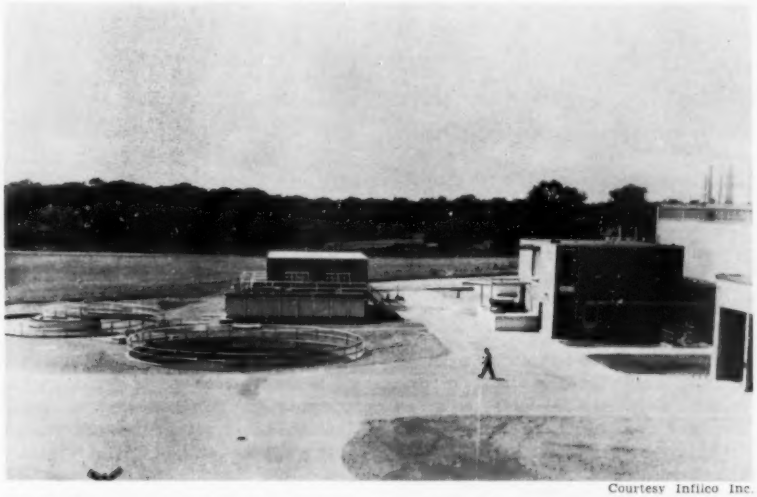
● **CLARIFICATION of process water is provided at this plant for Universal Cyclops Steel Co. The unit is 42-ft. diameter and 15 ft. side water depth, handles 2250 gpm.**

3) The sanitary consultant is conversant, or should be, with all methods, and processes of treatment, new and old, of liquids and solids, for reducing, removing or eliminating the polluting elements. He is trained to evaluate methods in their relation to the specified requirements, the waste constituents in the specific case and the cost of treatment.

4) He is trained to adjust the treatment of a given waste to local conditions—the needs of the stream into which ultimate discharge will be made, the local sewerage system and the local sewage treatment plant. He can determine, knowing the type of treatment process in the local sewage treatment works, just what preliminary treatment is required to produce a desired result without interfering with the plant efficiency. He can evaluate possible

disposal by dilution, by partial pretreatment or complete treatment at the source; or by the use of public utilities.

5) In the majority of cases he can save considerable money for his client by eliminating the need for costly experimentation, pilot plants and expensive trial periods. He knows the different processes, their limitations and advantages, and can, with a knowledge of the wastes, design a plant which can be depended upon to secure the desired results.



Courtesy Inflico Inc.

● **PLANT recovers about 70 percent of metal finishing waste waters for re-use in plating and plant operations. Maytag Co. plant at right. Black & Veatch, Engineers.**

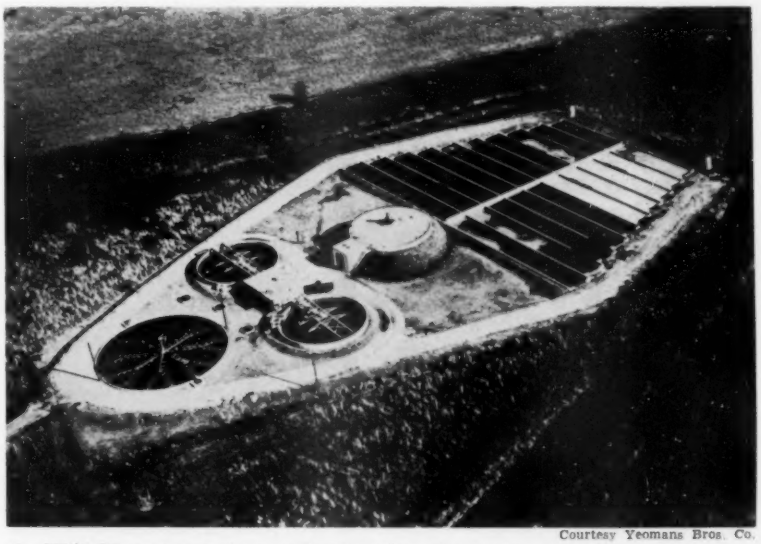
6) In cases where the waste is to be discharged into a local system, he is accustomed to evaluating the basis of sewer charges or charges for excess constituents and to obtain a fair deal for his client.

7) He is able to differentiate between the demands of a State regulatory agency and a municipal one having jurisdiction in the same case; to determine what is needed in the type and scope of treatment facilities. In one case handled by the author, the State concern was over the concentration of cyanide in the river, whereas the city, receiving the treated waste effluent in its sewerage system, was mainly interested in the final concentration of copper in the final effluent, as this affected their sludge digestion process. Knowing these two different angles it was possible to design a plant to satisfy both.

The consulting sanitary engineer is trained in biology, bacteriology, environmental health and general public health considerations. He can evaluate the polluting elements in streams; the constituents of surface water which indicate the extent of treatment for potable purposes; and the uses of a particular stream, which in turn indicates the extent of treatment of wastes to be discharged into it. He knows the result of combining different wastes to obtain mutual reactions which save treatment cost.

He can evaluate whether a waste may be treated biologically, chemically or by a combination of both. A manufacturer discharging a waste which is primarily of a complex chemical nature, with little or no organic matter, may say that a chemical engineer is best fitted to handle his problem. For the reasons given above and for others, too numerous to cover in the space of this article, this is not so. The team should consist of a leader—a consulting sanitary engineer—to act as quarterback, to call the signals, direct the play and run the game for the touchdown of a result satisfactory to the regulatory agencies involved and practical and economical for the plant owners. In this he needs the assistance of the plant chemical engineers and others to obtain needed data. In every case where a consulting sanitary engineer is called upon to solve an industrial waste problem it should be a part of his contract that the plant staff will assist in obtaining all needed data as to waste volumes, processes and concentrations.

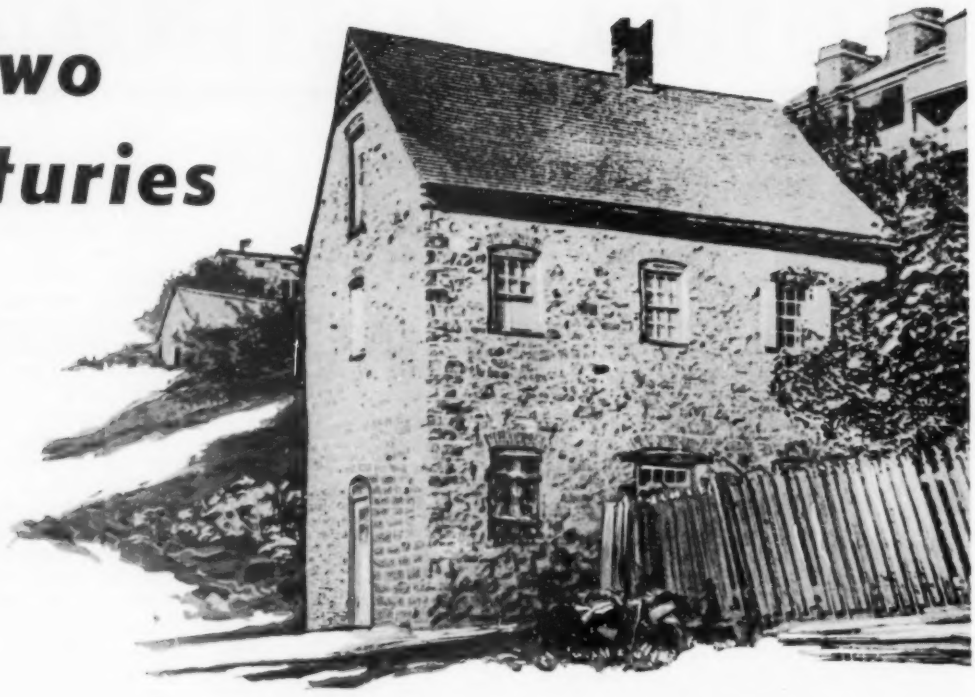
There are over 70 different criteria which may enter into the solution of a single industrial waste problem, and because they are the same criteria which normally face the consulting sanitary engineer in handling municipal sewage problems, he is best qualified to handle any liquid industrial waste project.



Courtesy Yeomans Bros. Co.

● **SEWAGE treatment plant at Tupelo, Miss., also treats wastes from a dairy, from a laundry and from other light industries. This is an example of a multi-use plant.**

Two Centuries



OF WATER WORKS PROGRESS

HARVEY R. FRANTZ,
Executive Director,
Bethlehem Authority,
Bethlehem, Pennsylvania

IT WAS in Bethlehem on May 27, 1755, that the first pumped water works in the United States went into operation. As historical records say, "At last, the occupation of the water carriers, trudging up the hill from the spring of Bethlehem was at an end."

The City of Boston puts forth the claim of having the first American public water system in 1652. However, this just served one neighborhood, Conduit Street. A century later the first supply designed to serve an entire community came into being when a farmer piped a supply from his farm spring, down the main street, in what is now Schaefferstown, Pa. Both of these systems were gravity fed to a trough where the people still had to go to fill their pails and jugs.

Even before the water works was developed, the Moravian settlers of Bethlehem had concern for their water supply. In 1747 the Village Board, in order to protect the spring from domestic animals and barnyard fowls, enclosed it with a fence. Two men, Matthew Weiss and Joseph Powell, were appointed to clean it, but only "in the light of the moon", as this was declared to be the best time by those possessed of "Pennsylvania Knowledge." It was claimed that the springs in this section of the country had the peculiarity of drying up if stirred at the wrong time.

The water works system consisted of a wooden tower, erected in the community square, and a small frame building housing the pumping machinery which was situated near the town spring. The first pump, of 5-inch diameter, was made of West Indian lignum vitae wood. In 1762 a stone building, designed

CITY OF BETHLEHEM
WATER SUPPLY
PENN FOREST RESERVOIR
HEIGHT OF DAM - 145 FEET
MAXIMUM WATER DEPTH - 125 FEET
CAPACITY - 6 BILLION GALLONS
LENGTH OF SHORE LINE - 7 MILES
AREA OF WATER SURFACE - 461 ACRES
AREA OF WATERSHED - 17 SQUARE MILES
TOP LENGTH OF DAM - 2,015 FEET
TOP WIDTH OF DAM - 30 FEET
MAXIMUM BOTTOM WIDTH - 800 FEET
EARTH AND ROCK FILL IN DAM - 2,000,000 CUBIC YARDS
ELEVATIONS
PENN FOREST DAM SPILLWAY - 1,000
WILD CREEK DAM SPILLWAY - 820
BROAD AND NEW STREETS 340
COMPLETED 1958

● **VISITORS to the new Penn Forest Reservoir find this sign setting forth details on size and capacity. At the top of the page is shown the first municipal water pumping station in America, put into operation at Bethlehem, Pa., in 1755.**

by Hans Christianson, the local millwright, was erected for the new machinery. This machinery consisted of three self-acting force pumps, cast at the old Durham furnace, with a triple crank forged by Brother Blum, the Moravian community blacksmith. The pumps, with power produced by a water wheel, forced the water from the spring to the tower, a height of 70 feet. This was later increased to 112 feet. From the tower the water flowed in wooden pipes, made from selected hemlock logs, to the cabins clustered around the town square.

The total cost of this water works, including the tile covered stone building, pumps and machinery, was 514 pounds, 16 shillings, 5 pence or approximately $2,471.30. Today Bethlehem's water plant is valued at about $29,000,000.

Nothing attracted the visitors to Bethlehem so much as the water works. The Indians were ever amazed at the water system and news of "the white man's water that works" travelled far beyond the frontier into the unknown land of western Pennsylvania and Ohio.

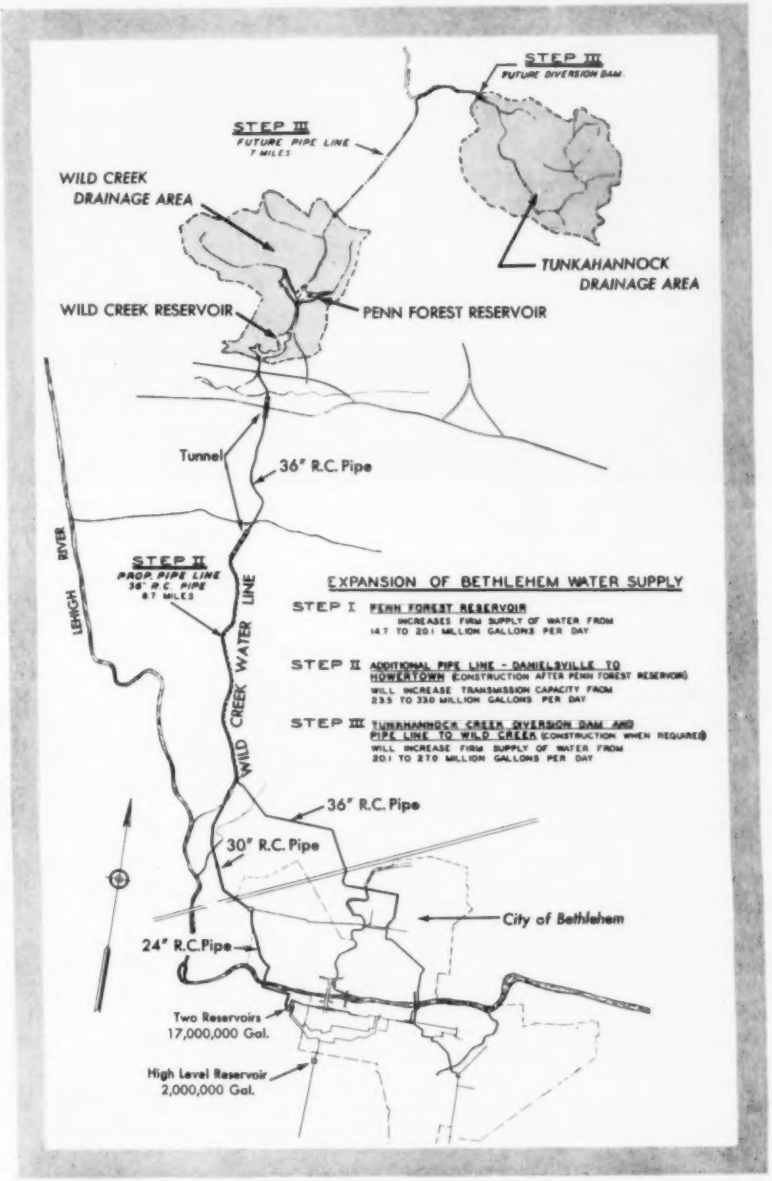
Eventually, the wooden tower was replaced by an octagonal tower in 1802 and later by an iron standpipe in 1826. Because of the pressure developed, gum wood replaced hemlock for the force mains and pitch pine was used for the other mains. However, there were many interruptions and disappointments because of bursting mains and, in 1825 the Water Board began laying iron pipes instead of wooden ones. Lead pipe had been experimented with but was discontinued in favor of the iron pipe. The gristmill that shared the building with the water works continued to grind out oat and buckwheat meal until 1847, when the water works took over the entire building.

The water supply continued to be in charge of a Water Board until 1847, when the "Bethlehem Water Company" was incorporated. This, in turn, sold out to the Borough of Bethlehem in 1870.

The spring supplied water to the town until 1912, when because of contamination it had to be abandoned. The town then turned to deep wells for its water supply. Across the river, the Borough of South Bethlehem had been using the water of the Lehigh River for its municipal needs since 1865. When the boroughs, Bethlehem and South Bethlehem, incorporated in 1917, the City of Bethlehem then received its water supply from two sources, deep wells and the Lehigh River, with more than 86 percent coming from the latter.

The Lehigh River was used until population growth and increased stream pollution forced the City to look elsewhere for its water supply. However, the City Engineer was prepared, as he had been studying potential dam and reservoir sites in the mountains to the north for years. The Wild Creek watershed had been selected as the most logical site. So, when WPA funds were available in 1939, Bethlehem took the big step. It was not simply a matter of moving in. First, the land had to be purchased; permits had to be obtained from the State to take a certain amount of the flow of Wild Creek; and other permits and easements had to be secured from actual and potential water users downstream.

Construction on the dam and reservoir and also on a 27-mile pipe line needed to bring the water to Bethlehem commenced in 1939. By 1941 the 4.1 billion gallon capacity reservoir was completed and the City's new source of water supply went into operation. The valve was closed in January and by the following September the reservoir was filled.



● **GENERAL PLAN of the mountain water supply and transmission system for the City of Bethlehem, Pennsylvania, showing the recent expansion and future program.**

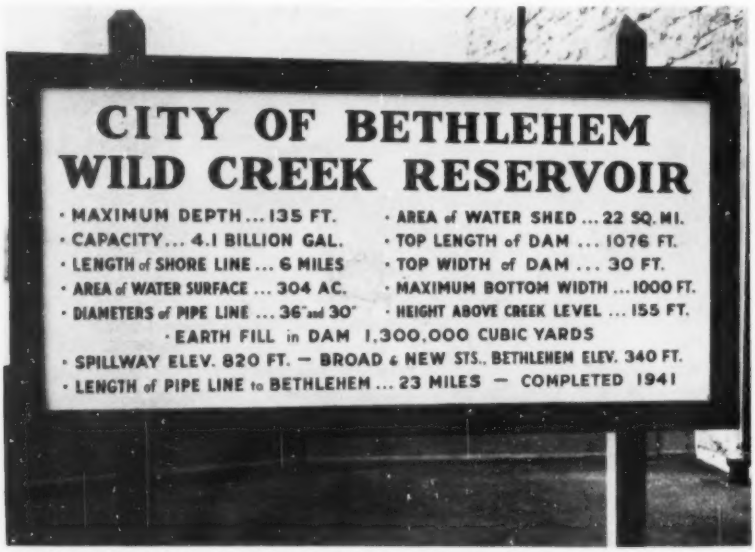
Judging by past records, Bethlehem's water worries should have been over for many years to come, but with the war and its increased industries and housing developments, the City was again casting around for a way to increase the water supply. From 1940 to 1944 the water consumption increased from 6½ mgd to 17 mgd.

As usual, the City Engineer had anticipated this and was ready with a plan. This contemplated constructing a 6-billion gallon reservoir a mile above the present Wild Creek Reservoir to store the excess water that would be lost over the Wild Creek spillway during high water, while in periods of low flow it would in turn keep the Wild Creek Reservoir full.

With the completion of the Penn Forest dam and reservoir, the combined storage capacity is over 10 billion gallons. Deducting for required governmental releases, evaporation and other losses and for maintaining a reserve of 20 percent in the lower reservoir, Wild Creek, there will be a 300-day storage capacity at a rate of use of 23.5 million gallons per day.

The pipe line is constructed of reinforced concrete cylinder pipe furnished by the Lock Joint Pipe Company. From the Wild Creek Dam to the City of Bethlehem the line passes through two tunnels. The first, under Wire Ridge, is 4,600 ft. long; and the second tunnel, through the Blue Mountain, is 5,890 ft. in length.

The pipe line from the Wild Creek dam is 36 inches in diameter, and where it enters the Wire Ridge Tunnel, it graduates into a 38-inch steel pipe, then into a 48-inch pressure tunnel for 2,341.97 ft. The pressure tunnel leads into a 38-inch steel pipe, and back into a 36-inch pipe. The same process applies to the tunnel through the Blue Mountain, although there the 48-inch pressure is 3,244.72 ft. in length. From the southern portal of this tunnel to Bethlehem, the pipe line is 30 inches in diameter.


CITY OF BETHLEHEM
WILD CREEK RESERVOIR
· MAXIMUM DEPTH ... 135 FT.
· CAPACITY ... 4.1 BILLION GAL.
· LENGTH of SHORE LINE ... 6 MILES
· AREA of WATER SURFACE ... 304 AC.
· DIAMETERS of PIPE LINE ... 36" and 30"
· AREA of WATER SHED ... 22 SQ. MI.
· TOP LENGTH of DAM ... 1076 FT.
· TOP WIDTH of DAM ... 30 FT.
· MAXIMUM BOTTOM WIDTH ... 1000 FT.
· HEIGHT ABOVE CREEK LEVEL ... 155 FT.
· EARTH FILL in DAM 1,300,000 CUBIC YARDS
· SPILLWAY ELEV. 820 FT. — BROAD & NEW STS., BETHLEHEM ELEV. 340 FT.
· LENGTH of PIPE LINE to BETHLEHEM ... 23 MILES — COMPLETED 1941

● **CONSTRUCTION of the Wild Crek Reservoir, which was completed in 1941, was a major step in expanding Bethlehem's water supply. Sign at reservoir gives details.**

The construction of an additional pipe line from Howertown to Danielsville will make possible the delivery of 30 million gallons of water per day to Bethlehem. However, this would not be a firm supply until the Tunkhannock drainage project, 7½ miles to the northeast of the Wild Creek area, is fully completed. This involves a small catchment basin on the Tunkhannock to divert flood flows through a 7½-mile pipe line into Heil Creek and thence to Penn Forest Reservoir.

The citizens of Bethlehem are still drinking Lehigh River water, but the river is tapped well above sources of pollution, and the water is stored in deep reservoirs. There it remains cool and clean, and after a minimum of chlorination treatment as prescribed by State standards, it is brought across country, still protected, to the City.

The Bethlehem Authority, one of the first in the Commonwealth, was incorporated August 24, 1938. The Authority completed the Wild Creek project at a cost of $4,200,000 which included the land, reservoir, dam, two tunnels and the 27-mile pipe line. The $1,000,000 outstanding in bonds was paid off with the new $8,000,000 bond issue sold in 1956 for the construction of the Penn Forest Dam and Reservoir.

In order to secure and pay off this bond issue, the Authority leases the entire water system to the City for an annual rental sufficient to retire the bonds in 40 years.

Not only does the Authority own the Wild Creek reservoir and the Penn Forest reservoir but it also owns and manages 10,000 acres of the total 14,000 acres in the Wild Creek watershed. In the Tunkhannock area, the Authority now controls 4,000 acres of the 12,000 acres in that watershed. These lands are under the supervision of a forester who manages them for multiple use. Altogether the Authority owns approximately 22 square miles of watershed.

It has been a long way from the town spring to the present system, but the results have been worth it. The people of Bethlehem today enjoy one of the least expensive water systems, as well as one of the highest quality sources to be found anywhere in this country.

Short Courses in Sanitary Engineering

The Public Health Service Sanitary Engineering Center is planning a Summer Training Institute to be held at the Western Massachusetts Public Health Center on the campus of the University of Massachusetts. The courses will be similar in content to those presented at the Robert A. Taft Sanitary Engineering Center in Cincinnati. Four sanitary engineering courses on the graduate level will be offered as follows: July 20-31, Basic Radiological Health; July 27-Aug. 7, Water Pollution Biology for Engineers; Aug. 3-14, Atmospheric and Source Sampling; and Aug. 10-14, Bio-Assay of Pollution Ecology (mainly for persons interested in State conservation, and fish and wildlife).

Applications and further information may be obtained from Sylvan C. Martin, Sanitary Engineer Director, Regional Engineer, Region II, Public Health Service, 42 Broadway, New York 4, New York.

STREET CLEANING *in a RESIDENTIAL COUNTY*

F. H. DOE, JR.
Sanitary Engineer,
Arlington County, Va.

ARLINGTON County, Va., with a population of 171,500 in a 25.5 square mile area, is an urban county directly across the Potomac River from Washington, D. C. It is largely residential in character, having only a small amount of light industry. The commercial areas are mostly neighborhood shopping centers. Of the 406 miles of streets, 20 miles are maintained by the Federal Government and 32 miles are maintained by the Virginia Department of Highways. The remainder are a county responsibility.

Arlington's street cleaning activities are largely confined to the business districts. There are 12 whitewings assigned to the 8 major shopping areas. An Elgin power sweeper cleans the main streets between the shopping areas and as many of the hot-mix residential streets as possible. However, most of the residential streets are surface-treated and it has been found undesirable to use the power sweeper on these streets because the sweeper causes damage to the pavement surfacing.

● **LITTERBUGS can't say that they didn't notice this trash receptacle; it has been repainted yellow and red.**

A 1500-gallon Standard Steel street flusher has recently been purchased with the thought that the gutters in the residential area can be flushed without damage to the pavement by using only the curbside nozzles.

Two Tarco street carts provide what we hope will be a better method of handling the refuse collected by the whitewings. Our present practice is to dump the contents of the street carts on the pavement near the gutter until the clean up crew with a dump truck comes along to shovel it up. The new plan is to furnish each whitewing with six cans and, as the cans are filled, he will exchange them for empty ones placed at pre-determined points. The dump-truck crew will empty the cans on a regular schedule. Two large weather resistant boxes have been built on which to store the carts. A box is placed in the area assigned to the whitewing using the carts. These boxes can be locked.

The power sweeper cleans about 1100 gutter miles per year and the whitewings average about 26 gutter miles per week. The current budget appropriation for street cleaning is $61,866, giving a per capita cost of $0.36.

We are in the process of repainting the 113 street trash receptacles bright yellow with red letters. We believe that if they are more noticeable, more people may use them.

Arlington has two Good Roads vacuum leaf loaders mounted on dump truck chasses. During October, November and December of last year 384 loads of leaves were collected.

● **CAN CARRIERS made by Tarrant Mfg. Co. hold two cans. These are exchanged for empty ones at predetermined points.**

● **ONE OF THE two Good Roads vacuum leaf loaders used by Arlington County for leaf collection during the Fall months.**

STANDARD PLANS FOR BRIDGES

STANDARDIZATION of plans for frequently used bridge structures offers many advantages and economies in the preparation of designs and specifications. Because of the growing interest in the use of such plans, the Editors of PUBLIC WORKS have written to the bridge engineers of a number of state highway departments to determine whether they have standard plans for bridges 20-foot in span and under. In addition, the engineers were asked if these standards were used by counties and cities and whether they were used on primary or secondary roads.

Replies received from eight typical states are shown below. These indicate that, in a substantial number of areas, these standard state plans are followed to advantage by local engineers.

CALIFORNIA

As reported by **A. L. ELLIOTT, Bridge Engineer—Planning, California Department of Public Works**

Standard plans for bridge structures which cover spans 20 ft. and less are as follows: Standard reinforced concrete box culverts; standard reinforced concrete arch culverts; and standard reinforced concrete continuous slab bridges. The standard plans for both the box culverts and the arch culverts are inserted directly into contract plans. The standard plans for the standard continuous slab bridges are used as reference material for detailing of the contract plans. The combination of spans that can be utilized in making up a structure is quite flexible. Their use has shown that a tremendous amount of time is saved in preparing the plans for this type of structure, rather than to make individual designs for each installation.

All of these standards are used on both the primary and secondary roads in the State of California. It is very seldom that a structure is designed for a loading less than the H-20 S16 44, and when it is, the structure would quite possibly be located on one of the county roads where traffic is light.

Various cities and counties have made use of all of these standards, particularly those for the continuous standard slab bridges. The State of California maintains a liaison with the various County Engineers, and in many instances they have requested the use of our standard structures in assisting them in preparing plans on both the county and Federal Aid Secondary roads.

KANSAS

As reported by **GEORGE EPPS, Bridge Engineer Kansas State Highway Commission**

The work of our Department is entirely on the County Secondary Roads and other County and Township bridges. We have prepared the standard designs for a large number of reinforced concrete box type bridges. Ordinarily, these will have individual spans from 7 ft. to 20 ft. Each standard provides for 3 or more spans. The height of the boxes will vary from 3 or 4 ft. to a height equal to the span. We also have standard bridge details for double span openings having spans of 10, 12 and 14 ft.

The Counties use these standards on many of their roads but Kansas cities seldom have occasion to use them. These details are furnished for the Counties as cloth reproductions which they incorporate into their plans for Federal aid Secondary projects or use directly as they see fit on other County projects. The Federal aid projects are contracted for the Counties by the State Highway Commission.

Some typical structures of this type are: 2@ 12x10 R.C.B. 26-ft. Rdw., Kiowa Co., F.A. Proj. 49-S 1001 (3); 3@ 8x5 R.C.B. 28-ft. Rdw., Osborne Co., F.A. Proj. 71-S 944 (3); and 3@ 14x14 R.C.B. 26-ft. Rdw., Linn Co., F.A. Proj. 54-S 420 (3). Our Standard designs are based on a one-lane H-15 live load using the specification of the AASHO.

MISSOURI

As reported by **J. A. WILLIAMS, Bridge Engineer Missouri State Highway Commission**

The only standard plans that we have for bridges 20-ft. in span and under are standard culvert designs which may be single or double box culverts. We have standard plans of this type for our Interstate, Primary and Secondary Roads. The standard culvert plans that we use are available for the use of counties or cities in case they wish to use any of them.

In addition to the standard culvert plans which we have mentioned above, we do have a standard precast channel slab which is for 21½-ft. spans. This type of bridge is used only on our supplementary routes and is designed for H-10 and H-15 loadings.

NORTH CAROLINA

As reported by
T. B. GUNTER, JR.,
Assistant Chief Engineer,
Bridges,
North Carolina
State Highway Commission

We use a 17-ft. standard span with creosote timber joists with concrete floor and rails. These spans are made 17-ft. center to center of supports in order to use standard 18-ft. lengths of timbers. Spikes are driven into the tops of the timber joists and left protruding in order to provide composite action of the timber joists and the concrete floor. This type of structure is used both on primary and secondary roads. Since the N. C. State Highway Commission has jurisdiction over county roads as well as numbered state highways, counties in this state do not build state highway structures. So far as is known, cities in North Carolina have not used this type of construction. This type of structure has been used for approximately 30 years and has given very satisfactory service.

OHIO

As reported by
D. H. OVERMAN,
Engineer of Bridges,
Ohio Department of Highways

This department has for many years used standard plans for bridges of 20-ft. span and under and also for bridges for much longer lengths. For structures of 20-ft. or less, the following standards are in general use: Single span concrete slab bridges, spans 9 to 32 ft.; concrete box culverts, spans 7 to 20 ft.; and structural corrugated pipe and pipe-arches, spans 5 to 16 ft.

The slab bridge standards are sufficiently detailed to serve as a part of the contract plans, a general plan and elevation generally being enough to show the roadway width, the skew and the depth and type of footings. A plan and elevation of most culverts are also shown on the contract plans together with special details as may be required.

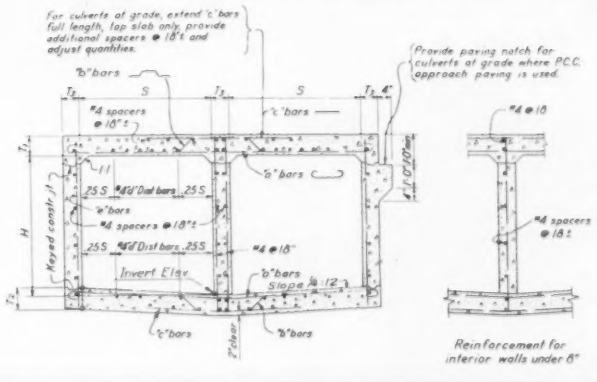
MICHIGAN

As reported by
M. ROTHSTEIN,
Assistant Engineer of Design,
Michigan State
Highway Department

In Michigan, structures under 20-ft. in span are referred to as culverts and we maintain standards for clear spans from 3 ft. to 16 ft. These are slab spans and box culverts.

County and City agencies use our standards to quite some extent, and we encourage such usage. The plans are used on both primary and secondary roads. Our standard plans are sufficiently complete in all details to be used directly in contracts. Quantities are shown on the standard plans on a "per foot" basis and consequently can be used, when applicable, with only a computation of length required by the designer.

SPAN	4										5												6											
HEIGHT	2			3				4			2			3				4				5				3			4				5				6		
STRENGTH CLASSIFICATION	A	B	C	A	B	C	D	A	B	C	D	A	B	C	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Conc — Top Slab T_1	6½	6½	7¼	6½	6½	7¼	8½	6½	6½	7¼	8½	7	7	8½	7	7	8½		7	7	8½	10¼	7	7	8½	10¼	7½	8	10	7½	8	10	11½	7½	8	10	11½
Bottom Slab T_2	6	7	8½	6	7	8½	9½	6	7	8½	9½	6½	8½	10	6½	8½	10		6½	8½	10	11¼	6½	8½	10	11¼	6¾	9¼	11	6¾	9¼	11	12½	6¾	9¼	11	12½
Sidewalls T_3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	6	6	7
Reinforcing Steel — a — Size Bar#	5	5	4	5	5	4	4	5	5	4	4	5	5	4	5	5	4		5	5	4	5	5	5	4	5	5	4	4	5	5	4	4	5	5	4	4	5
a — Spacing	14	14	12	14	14	12	10	14	14	12	10	13	12	10	13	12	10		13	12	10	12	13	12	10	12	12	11	9	12	11	9	12	11	9	10	12	11	9	10
a — Length	10-3	10-3	10-2	10-3	10-3	10-2	10-2	10-3	10-3	10-2	10-2	12-3	12-3	12-2	12-3	12-3	12-2		12-3	12-3	12-2	12-3	12-3	12-3	12-2	12-3	14-3	14-2	14-2	14-3	14-2	14-2	14-2	14-3	14-3	14-2	14-2	14-3
b — Size Bar#	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		5	5	5	6	5	5	5	6	5	5	5	5	5	5	6	5	5	5	6	
b — Spacing	14	14	12	14	14	12	10	14	14	12	10	13	12	10	13	12	10		13	12	10	12	13	12	10	12	12	11	9	12	11	9	12	11	9	10	12	11	9	10
b — Length	9-6	9-6	9-7	9-6	9-6	9-7	9-8	9-6	9-6	9-7	9-8	11-7	11-7	11-6	11-7	11-7	11-6		11-7	11-7	11-6	11-9	11-7	11-7	11-6	11-9	13-7	13-6	13-9	13-7	13-6	13-9	13-10	13-7	13-6	13-9	13-10	13-7
c — Size Bar#	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		5	5	5	6	5	5	5	6	5	5	5	5	5	5	6	5	5	5	6	
c — Spacing	14	14	12	14	14	12	10	14	14	12	10	13	12	10	13	12	10		13	12	10	12	13	12	10	12	12	11	9	12	11	9	12	11	9	10	12	11	9	10
c — Length	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	4-6	5-6	5-6	5-6	5-6	5-6	5-6		5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6	6-6	6-7
'd' Dist Bars — Top Slab - No of	6	6	6	6	6	6	6	6	6	6	6	8	6	6	8	6	6		8	6	6	8	8	6	6	8	10	8	8	10	8	8	8	10	8	8	8	
Bot Slab - No of	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		6	6	6	8	6	6	6	8	8	8	8	8	8	8	8	8	8	8	8	
'e' Bars — Size Bar#	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4	5	5	
Spacing	18	18	18	18	18	18	18	18	18	15	10	18	18	18	18	18	18		18	18	15	10	18	15	9	7	18	18	18	18	15	18	15	9	12	18	9	8
Spacers Number	19			22				25				19			22				25				25				26			29				32				32		
Quan — Concrete C.Y. per Lin. Ft	0.53	0.51	0.57	0.53	0.57	0.63	0.70	0.59	0.62	0.68	0.75	0.59	0.66	0.77	0.65	0.72	0.83	0.91	0.78	0.88	0.99	1.06	0.83	0.94	1.04		0.77	0.89	1.05	0.83	0.95	1.10	0.88	1.00	1.16	1.29	0.94	1.08	1.22	1.41
Reinf. Lbs. " " "	68	68	68	72	72	72	80	75	75	75	87	82	86	87	85	90	91	90	93	95	116	90	95	101	123		107	100	116	110	104	120	113	108	128	158	113	114	137	170
Hydraulics — Area A	16			24				32				20			30				40				50				36			48				60				72		
Hydraulic Radius R	0.67			0.86				1.00				0.71			0.94				1.11				1.25				1.00			1.20				1.33				1.50		
Neutral Slope %	0.64			0.70				0.77				0.59			0.62				0.67				0.73				0.56			0.59				0.62				0.66		
Head Factor h	0.75			0.55				0.45				0.69			0.49				0.39				0.34				0.450			0.358				0.305				0.271		
Entrance Capacity Q_{18}	70			128				198				86			160				246				344				192			296				414				544		
Design Discharge Q_{max}	116			214				326				142			264				406				568				318			488				682				896		
Min Cover — Case II or VIII	5	15	24	5	15	24	34	5	15	24	34	4	14	24	4	14	24	4	4	14	24	34	4	14	24	34	4	14	23	4	14	23	32	4	14	23	32	
Case IX	5	16	32	5	16	32	65	5	16	32	65	4	15	32	4	15	32	4	4	15	32	65	4	15	32	65	4	15	28	4	15	28	47	4	15	28	47	
Case XI	5	12	17	5	12	17	23	5	12	17	23	4	11	17	4	11	17	4	4	11	17	22	4	11	17	22	4	12	17	4	12	17	23	4	12	17	23	


For culverts at grade, extend 'c' bars full length, top slab only, provide additional spacers @ 18" and adjust quantities.
"b" bars
"c" bars
#4 spacers @ 18" ±
Provide paving notch for culverts at grade where P.C.C. approach paving is used.
#4 @ 18"
#4 spacers @ 18" ±
Keyed constr. if
Invert Elev.
slope
Reinforcement for interior walls under 8'

Bar numbers denote nominal diameters of round bars in eighths of an inch

Note: For boxes of height less than that shown in table, use next greater table height slabs, wall dimensions and reinforcing steel, and make necessary changes in bar lengths, number of spacers and quantities.

● **THIS IS A PORTION of the sheet of standard plans used by the California Department of Public Works to cover double box culverts. The original sheet includes tabulated design data for spans of 8, 10, and 12 feet in addition to those shown above.**

WISCONSIN

As reported by
H. B. SCHULTZ,
Engineer of Bridges,
State Highway Commission of Wisconsin

The State Highway Commission of Wisconsin does not have any standard plans for structures 20 ft. and under.

Practically all of our drainage structures 20-ft. in span and under are of the single or twin reinforced concrete box culvert type. We have electronic computer programs which provide us with the design of these culverts and generally we are able to reproduce all or part of the details from plans in our files.

TEXAS

As reported by
RANDLE B. ALEXANDER,
Bridge Engineer,
Texas Highway Department

The only standards we have are those for single and multiple boxes having clear spans varying up to a maximum of 10 ft. The next standard we have is for a 25-ft. span. Standard box culverts are used on all of our highways including secondary, primary and interstate. To some extent these standard boxes are used by cities and counties.

PURCHASING AT THE STATE LEVEL

PAUL E. BOYER,
Administrator,
Bureau of Motor Transport,
Ohio Highway Department

THE EQUIPMENT procurement policies used by the Ohio Highway Department are based on our past experiences and, we feel, fit our requirements best.

First when the appropriation of departmental funds is made, a budgetary amount is set up for the procurement of new and replacement equipment of all types used by the Highway Department. This amount is based on the evaluation of the entire fleet, life expectancy of the various types of equipment involved, additional units required due to expansion of the highway program, and the amount of revenue available.

The Department is made up of several Central Office Divisions and twelve field divisions consisting of the eighty-eight counties. Allocations of appropriated funds are made to the Divisions based primarily on maintenance mileage, and geographic locations. The Divisions are advised to prepare a tentative equipment program within their budgetary allowance and, on a set date, personnel that are responsible for divisional equipment operations bring this program into the Bureau of Motor Transport. After consultation with the Chief Engineer of Maintenance and the head of Motor Transport, a definite program is established for the period covered by the appropriation.

In accord with the established program, requisitions are made by the respective Division and submitted to Motor Transport where specifications are prepared accordingly.

Such specifications are written with the intention of getting the equipment best suited for our requirements and of receiving competitive bids. With a specification such as this we are able to accept the low bid if the equipment proposed fully meets the specification. If it does not meet the specification, it is then possible to go to the next bidder that does.

After the requisitions are received from the Divisions and proper specifications prepared, they are submitted to the Purchasing Department where the invitations are prepared and distributed to potential bidders. Bids are received and tabulated and the complete file is referred to the Bureau of Motor Transport to be analyzed.

After analysis, a recommendation for award is made by Motor Transport to the Purchasing Department who in turn presents the matter to the Award Board for approval, after which the purchase order is written for the successful bidder.

The above outlined procedure and policy makes it possible to obtain the best possible equipment that meets requirements at lowest cost.

We do not consider service in accepting a bid; however, satisfactory service is usually normal with potential bidders because we get reputable manufacturers when we limit our specifications to the better equipment on the market. The number of bids received depends on the type of equipment; for example on passenger cars we may receive fifty or more bids; and on a brush chipper possibly only three. A demonstration of equipment is required before it is accepted, unless the type being purchased is one that has been on the market for some time and with which we are familiar.

All equipment delivered is checked against the respective specification before it is accepted. Bidders on all equipment are required to fill out a detailed questionnaire pertaining to the respective type being procured.

CITY HAS MANY JOBS FOR "PAYLOADER"

● **USED in all phases of maintenance and construction, this Hough Model HU "Payloader" owned by the public works department of Old Orchard Beach, Maine, has a rated carry capacity of 2½ tons and lift of 4 tons. The department has approximately 100 miles of streets to maintain, including about 6 miles of bathing beach.**

PARKWAY LIGHTING WILL ENHANCE MIAMI'S "21-NATION" GARDEN

AN OUTSTANDING feature in the development of Miami's Watson Island will be the "Garden of the Americas" in which 21 Latin American Nations will have an opportunity to display the plants of their own countries, as well as show their prowess in gardening, horticulture, architecture and landscape design. This garden is located on a City-owned Park-Island on the MacArthur Causeway, which connects Miami and Miami Beach. Actually, it will consist of 21 individual gardens on the 13-acre tract besides the general features and, ultimately, a pavilion which will include display areas and a plant conservatory.

The general layout was designed by the Engineering Department of the City of Miami. When completed it will have a series of garden designs provided by each country individually and tied together by a looped serpentine walk. The basic layout design, the path system, some grass and trees and the comfort station portion of the garden center already have been completed.

The entire garden is encircled by a loop road and has parking areas located at each end. A parkway lighting system recently installed by the City provides 31 fluorescent luminaires spaced at approximately 150-foot intervals along the road. Kerrigan Iron Works aluminum davit lighting standards are used to support General Electric Form 206 fluorescent luminaires with "Power Groove" lamps. This design harmonizes with the flowing lines of the loop road. Lighting of the Garden of the Americas ultimately will include numerous flood lights and special lighting treatments for specific needs.

As development of the park progresses, a complete irrigation system will be provided. At present there is a 4-in. pipe coming in near the center of the garden to feed the sprinkler system. This ties in to dual loops of 3-in. pipe which will serve the various detailed systems necessary for watering individual gardens as they are established. Landscaping of the garden will be maintained by the Parks Division. Other areas of maintenance will be handled largely by the Miami Department of Public Service.

● **FLUORESCENT luminaires mounted on graceful aluminum davits are spaced at intervals of approximately 150 feet along the loop road that circles the new garden.**

The Garden of the Americas is only a part of the overall plan for development of Watson Island by the City of Miami. The development includes extensive marine accommodations consisting of a marina, trailer boat launching ramp and provisions for both outboard and yacht clubs. The overall plan emphasizes the park-like aspect. Among its specific items are: A Tropical Fruit and Garden Park, the Garden of the Americas, a plant conservatory and picnic area. Space has also been allocated for a Municipal Heliport and a Sea Plane base.

Much of this information was based on data furnished by John L. Benson, City Landscape Architect.

● **ARTIST'S rendering shows how the Garden of the Americas will look when it is completed. Designs provided by 21 Nations will be joined by a serpentine walkway.**

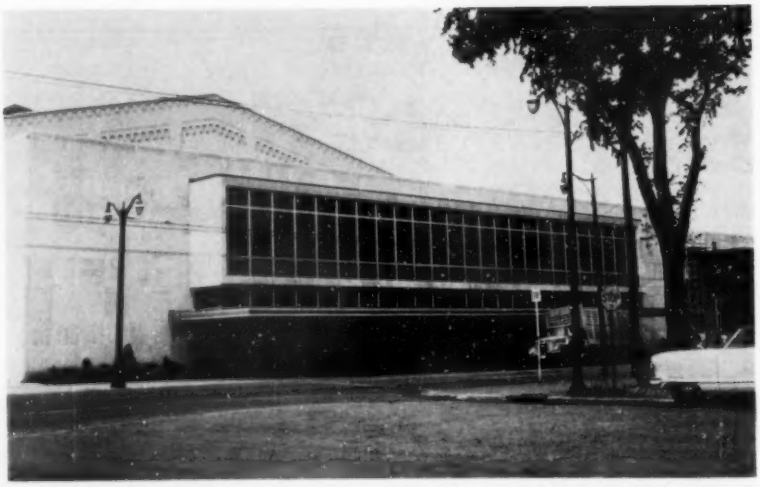
MODERNIZING
A MUNICIPAL AUDITORIUM

FRED McCALLUM,
Manager, Municipal Auditorium, Birmingham, Ala.

BIRMINGHAM'S civic center, facing Woodrow Wilson Park, and including a city hall, county courthouse, library and art museum, now has a new face, that of the municipal auditorium.

The auditorium is not exactly new as Birmingham erected a municipal hall in 1924, but it had become obsolete, not only in appearance, but in equipment. It was peeled down to the skeleton and practically rebuilt. Whereas the original structure cost $500,000, the job of modernizing cost $1,600,000. This included $600,000 voted in a bond issue for the purpose in 1955, and after this was found inadequate another bond issue of $1,000,000 was voted in 1957. Up until now nothing had been spent in modernization except that during the early 30's the old ceiling was replaced by a modern celotex, acoustically treated one. The present plant is valued at approximately $4,500,000.

The modernization program included air conditioning and new lighting and seating. In addition the building, which had been set back from the street, was extended up to the sidewalk. This permitted the erection of an entire new two-story addition which gave a new front to the old building, a new entrance lobby and an exhibition hall on the second floor, as well as meeting and conference rooms. The exhibition room of 11,000 square feet is reached by a freight elevator, so that automobiles or other heavy equipment may be moved onto the exhibition floor.



● **NEW PORTION of Birmingham's municipal auditorium is shown in the foreground. Cost of the modernization project, which included air conditioning, was $1.6 million.**

● **WITH SEATS removed from the central portion of the auditorium, space is provided for sports and other uses. Lighting and seating facilities were all renewed.**

The auditorium with a seating capacity of 5,090, approximately half of which is upholstered, is the largest in Alabama, and takes care of some 250 events during the year with an attendance of 600,000 to 750,000. This includes conventions, sport shows, legitimate stage shows, road shows, forums, religious programs, circuses, concerts, dances, exhibitions, trade shows, cooking schools and many others.

Movable Floor

A feature of the auditorium is the removable hardwood floor. Made of pressed plywood with masonite on each side, the floor is the safest type that could be bought. It is supported by steel scaffolding that interlocks. This floor elevates slightly away from the stage and is removed in case of various type exhibitions like ice shows, which require more room. Even when seats are moved out of the main floor there is still seating for about 3,000.

The stage complete with rigging and lighting is 50 by 100 feet in dimensions, or large enough for any type show or concert. All lighting can be controlled from the stage including the flush mounted house lighting which can be dimmed on or off. Footlights and spotlights enable

the lighting director to create additional stage effects. The new lighting has five times the capacity of the old installation. There are over 50 lines to control stage rigging and curtains. These are weighted for finger-tip balance. Lighting equipment includes a "preset board" where three types of lighting can be set up in advance. The lighting director works in cooperation with the stage director of traveling shows but works out the routine for local shows himself.

The main auditorium is served by a 440-ton Carrier air conditioning system with the main equipment being installed in the basement. Conditioned air reaches the auditorium from overhead diffusers which connect with ducts and air handling equipment in the attic. The ducts are sound insulated to make sure no noises will interfere with auditorium programs.

In addition to the main air conditioning system there is a 30-hp system to serve committee rooms downstairs and a 5-hp system for the offices and box offices. The separate systems were provided because these spaces will need conditioning at times when the auditorium is not in use.

In the remodeling process the coal-fed warm air heating system was converted to gas with oil for standby. Also the old ventilating fans which served the auditorium were torn out.

The city auditorium operates under the general direction of the City Commission which includes James W. Morgan as mayor and Eugene Connor and J. B. Waggoner as associate commissioners. An immediate staff for the auditorium includes 15 regular and 30 or 40 part-time employees, four of whom come under civil service. The author is auditorium manager.

Charles L. McCauley was architect on the auditorium remodeling job and Richardson Construction Co., the general contractor. The Hardy Corp. installed the air conditioning and Bagby Elevator & Electric Co., the new lighting and switchboards. All these are Birmingham concerns.

LEAF COLLECTION REQUIRES ADEQUATE EQUIPMENT

RUDY RIFE,
Director of Public Service,
Shaker Heights, Ohio

EARLY in the fall of 1957, the City of Shaker Heights purchased two machines made by The Good Roads Machinery Corp., to augment its leaf collection program. One machine was a self-contained truck mounted leaf collector; the other was a truck mounted scavenger.

Both machines were put into service after the leaves had been raked into piles on their lawns by the homeowners. The machines helped to solve the leaf problem. The piles could be picked quicker and in a much neater fashion than by any system we had used previously. Residents found this new method very efficient and were pleased to see the leaves disappear quickly and cleanly with a minimum of raking and cleanup thereafter.

The leaf collector picks up the leaves and grinds them by passage through an impeller. The piles should not contain stones or other objects that might damage the impeller. The scavenger picks up and deposits the leaves directly into a hopper eliminating any necessity for sorting.

We find these machines economical for early pickup of leaves. Our 1957 records for October indicate that two men operating one piece of equipment could pick up an average of six loads in an eight-hour day. Each load had an average weight of 2380 lbs., so that our daily average would run approximately 7.14 tons of leaves per machine.

Courtesy Good Roads Machinery Corp.

● **LEAF COLLECTOR** in action. The unit shown above is similar to the one purchased by Shaker Heights except for being mounted on a trailer instead of a truck.

O. R. P. and SEWAGE TREATMENT

JOHN W. HOOD,
Superintendent of Sewage Treatment, Ridgewood, New Jersey

This article is based on a paper presented at the 40th Texas Water and Sewage Works Association's Short School at College Station, Texas.

THE SIGNIFICANCE of O.R.P. as a fundamental ecological factor has long been appreciated by investigators in the realms of physics, chemistry, biochemistry, bacteriology and soil microbiology. By definition, O.R.P. is the oxidation-reduction potential or redox potential—an intensity, not a capacity factor. It is expressed in terms of electro-motive force, the voltage or electrical pressure found in the liquid as a result of the presence of respective concentrations of oxidant and reductant. This potential or electromotive force may be measured by means of a potentiometer equipped with an appropriate electrode system.

Hewitt[1] states: "Oxidation and reduction processes are defined in terms of electron migrations; oxidizing properties are due to a tendency to part with electrons, and reducing properties to a tendency to take up electrons. When one substance is oxidized (parts with electrons), another is always simultaneously reduced (takes up the electrons liberated). This electronic concept has suggested a method of studying quantitatively, these reversible oxidation-reduction processes which are of vital importance to the living cell. The method is the measurement of electrode potentials, which enable the degree of oxidation or reduction of a system to be gauged and which render possible the grading of oxidizing and reducing systems according to their intensity levels."

Pomeroy [5] in 1934 stated: "Many of the phenomena observed in the treatment of sewage may be understood more clearly if they were explained in terms of oxidation potentials . . . it seems probable that a knowledge of the values of oxidation potentials in various phases of treatment of sewage may prove of value, when correlated with other phenomena."

Rohlich[2] reduced these concepts to sewage treatment practice, by their application to the Madison, Wis., activated sludge plant process and to related laboratory studies simultaneously undertaken.

Since ecology is that branch of biology which is concerned with relationship of organisms and their environment, all environmental factors must be considered, but in their proper perspective.

Fair & Whipple[6] have related some thousand aquatic organisms to their preferred environment. This work points out that the sanitary ecology of aquatic organisms has been championed in particular by Kolkwitz and Marsson, whose ecological system of saprobic organisms was made the basis of classification. Kolkwitz and Marsson distinguished three broad zones of existence, the polysaprobic, mesosaprobic and oligosaprobic zones. These are characterized, in the order of their statement, by a gradual decrease in content of organic foodstuffs.

Much correlative work has already been done on the relationship of O.R.P. and ecology, productive of many practical applications. O.R.P. is being employed today in a variety of ways in sewage disposal. By controlling the environment or ecology, the nature of life and numbers of organisms may be dictated and controlled, and the end products of biological processing can be regulated within the desired values.

O.R.P. has been employed to advantage to determine whether degradation or decomposition is occurring in sewers, pump stations, force mains, trunk lines, or in one or more of the sewage treatment units. Domestic and industrial treatment plant failures have been readily diagnosed by O.R.P. and the causes pin-pointed. Toxicity may likewise be readily located. In sludge blankets, control over quantity and quality is best derived from O.R.P. values. This prevents decomposition, denitrification and creation of excessive blower loadings.

Essential Definitions

E_h is the potential difference at the "normal hydrogen electrode." In practice, various working standards such as the saturated potassium chloride-calomel half cell substitute for the normal hydrogen electrode in combination with a noble metal electrode such as platinum. Arbitrarily standardized values for half cells permit correction to E_h. [2]

Aeration is dispersion of air in an aqueous medium. *Oxidation*, chemically or bio-chemically induced, is 1) any process which increases the proportion of the oxygen or acid forming element or radical in a compound; 2) a process whereby hydrogen is removed; or 3) a process which involves a loss of electrons and an increase in positive valence. *Reduction* is a process which involves a gain of electrons; a tendency to take up electrons, with a

Correction to E_h from a Standard Half-Cell Potential
Example Using KCl(sat.) HgCl/Hg (20°C) = +0.250 v.

When dial reading	=	−0.432 volt (digester sample)
Half cell potential	=	+0.250 volt
O.R.P.	=	−0.182 v. or −182 millivolts E_h
Or when dial reading	=	+0.250 volt (aerator sample)
Half cell potential	=	+0.250 volt
O.R.P.	=	+0.500 v. or +500 millivolts E_h

decrease in positive valence. The electron is a unit of electrical charge. While we habitually speak of the flow of positive electricity, the evidence is for the flow of negative charges, the electrons. [2] *Polarity* is the quality of being attracted to one pole and repelled from another.

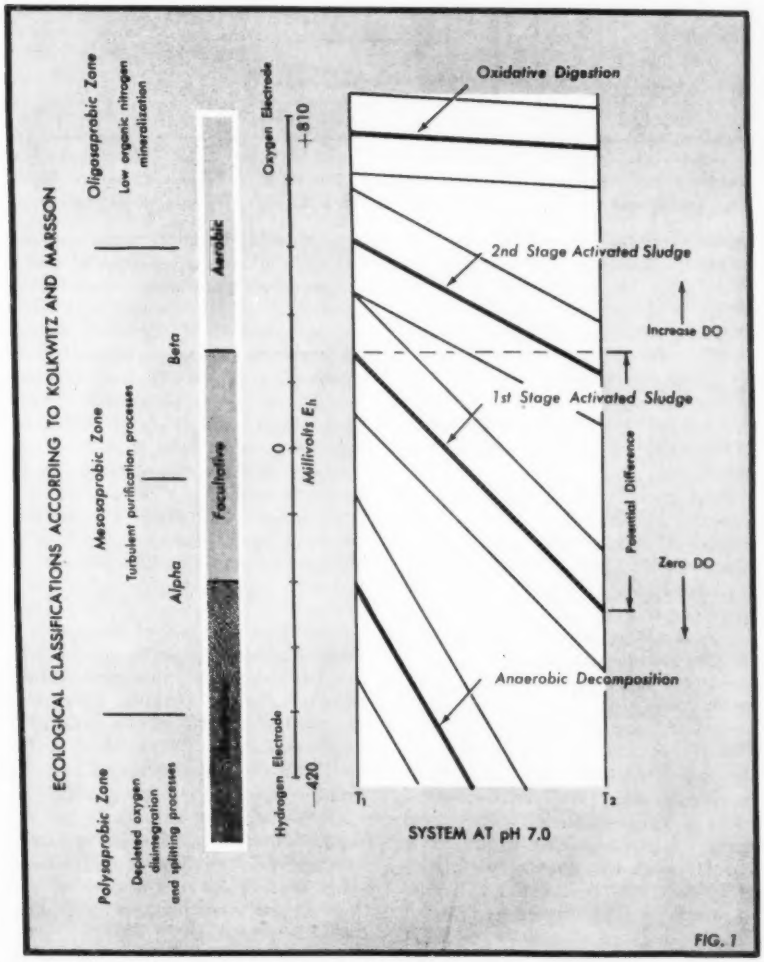
Electrolytic Properties

The fact that electric power can be generated from sewage and that sewage constitutes an electrolytic cell is not generally understood or appreciated. Pomeroy,[5] however, demonstrated this fact by operating a delicate electric motor on the potential produced by sewage during a California Section meeting at Yosemite in 1934. In a trial run at the laboratory of the Los Angeles County Sanitation District, the motor was operated 6 days on the energy from a pint of settled sewage.

Contemporary investigators have used potential or O.R.P. as a means of expressing the oxidative or reductive intensity level. Here is an example of its application which is more unusual:

The calculation of 5-day BOD is based on the assumption that the velocity of oxidation is a fixed constant. As a consequence, numerical BOD values of raw and oxidized effluent in a given plant may not be directly compared, since they were actually derived from dissimilar velocity constants.[7] An arbitrary 5-day BOD could be a 3½-day or a 7-day BOD in reality! An understanding of this complication is best obtained through a study of ecology.

Figure 1 portrays the various ecological classifications; their general relationship to an arbitrary O.R.P. scale, to the three general bacteriological classifications, and to sludge activity in various processes having differing oxidative intensity levels.



● **SCHEMATIC portrayal of the relative oxidative and reductive intensity levels encountered in various phases of sewage treatment and arbitrary correlation of an ecological classification system of organisms with oxidation reduction potentials.**

In a manner analogous to the rapid dry combustion of fuel in the presence of ample draft or air supply, so the wet combustion of organic matter in an aqueous medium (such as occurs in the activated sludge process) is accelerated by high potential conditions. Hence in a raw sewage BOD dilution, the potential level would be lower than in the BOD dilution of an oxidized effluent.

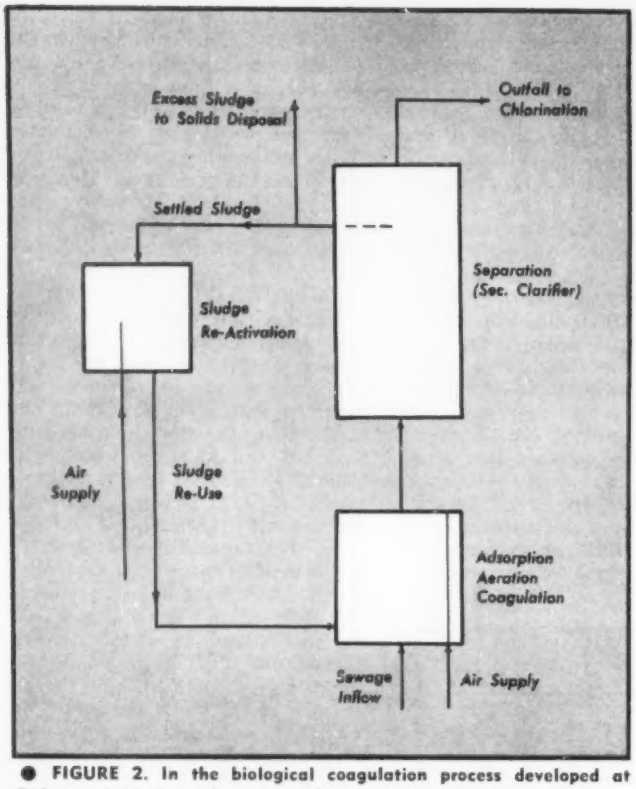
Now potential is not a commercial commodity, but a qualitative aspect of a biological system. The engineer designs the structures and thereafter the operator should establish and maintain therein an ecology in accordance with the teachings of Kolkwitz and Marsson, which will produce the desired process end results—and incidentally exhibit its concomitant potential. Waksman[3] states that organisms will establish and maintain their own favorable potential, given the necessary means and time. Hence for example we find that nitrification occurs in the oligosaprobic zone at high *positive* O.R.P. or oxidative intensity level. On the other hand reduction or anaerobic decomposition occurs in the polysaprobic zone at enhanced *negative* potential.

Thus O.R.P. is an effect rather than a cause. It is a qualitative aspect which may be regulated by operational control. Conversely, this qualitative concept may then be employed for quantitative control to maintain process uniformity in the presence of many variables, given the necessary correlative information. And the procedure for measurement of O.R.P. differs but slightly from the electrometric determination of pH, so that it can readily be included in routine plant analyses.

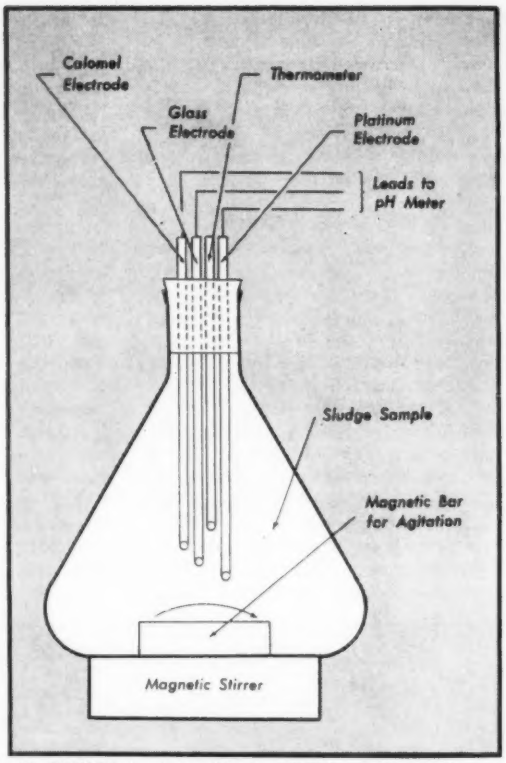
Activated Sludge

Briefly, the activated sludge process is a wet oxidation biological process capable of producing a highly clarified effluent having low bacteriological count, low BOD and low suspended solids values and also capable of attaining mineralization. All of the pertinent factors combine to constitute an ecology which in turn dictates the process capabilities and hence the degree of treatment.

It has been demonstrated that the variables in sewage volume, character and plant structures induce variations in the ecology and affect the process efficiency and the degree of treatment. Hence the operator's problem is one of producing a constant ecology in spite of these variables.



● **FIGURE 2. In the biological coagulation process developed at Ridgewood, N. J., and portrayed here, optimum biological conditions are maintained by modulating the air supply to a steady-state O.R.P.**



● **FIGURE 4. Assembly for O.R.P. determination of sludge activity. The flask is filled with mixed liquor; leads are connected with electrodes and potentiometer.**

Biological Coagulation

Assuming that biological coagulation similar to the Ridgewood Process, capable of 90-95 percent BOD and suspended solids reductions is desired, then referring again to Figure 1, we see that the ecology of the system is characteristic of the beta mesosaprobic zone. Previous research has developed correlative O.R.P. values as indicated by the first stage activated sludge curve. The "steady state" mixed liquor potential, indicated by a broken horizontal line should be in the general magnitude of plus 300 millivolts E_h. Air supply is the primary oxidant, and in order to produce a steady O.R.P., modulation or variation of the air supply will be required to pace the oxygen uptake due to the oxygen demand exerted by the incoming BOD plus the respiratory requirements of the aerobic population (mixed liquor solids or zoogleal matrix).

This modulation may be laboriously accomplished by a bench technique and manual programming of air supply valves. The current construction at Ridgewood, N. J., however, incorporates continuous automatic measurement of mixed liquor O.R.P., and these measurements automatically provide continuous modulation of the air supply to the process. Increase or decrease in D.O. may be accomplished by a simple adjustment of the O.R.P. recorder/controller. Thus, a "steady state" potential will be maintained by automatic modulation of the supply of the primary oxidant or oxygen, to meet the demand at all times. This completes the first process requirement.

Next we turn our attention to the question of food and "diners." Glossing over considerations of particle size, efficiency of mixing, oxygen transfer, etc., we deal with the simple problem of proportioning diners to food, or maintaining the correct return sludge ratio. This is important because overloading or underloading of sludge particles is known to produce equally undesirable process results. More important still when considering the food to organisms ratio, we are concerned with a very important ecological factor. Again referring to Kolkwitz and Marsson this factor covers the entire range of bacteriological classification. "Sludge volume index" and foaming are also closely related to this consideration. Microscopy reveals that an activated sludge process controlled within the beta mesosaprobic zone is composed of a mixed population of protozoa and bacteria. Particle density and sludge volume index are at optimum (S.V.I. generally 100); foaming is absent; coagulation and clarification are excellent—the operators' dream!

Figure 4 shows the assembly employed in bench technique for the determining of potential difference with respect to time (or sludge activity). Research developed specific potential difference values for the Ridgewood Biological Coagulation Process, but this work failed to produce the necessary instrumentation for auto-control due to the inherent difficulties. However, Project Engineer Ray Condell of Fischer and Porter solved this problem by pointing out that since the modulated air supply was a variable (resulting from a controlled constant O.R.P.) and was directly proportional to the BOD of the admixture undergoing treatment, means of modulating the return sludge (or organisms to food supply ratio) could be derived from the variable air flow measurement. This feature is also a part of the automation procedures in the Ridgewood improvement program.

Now the slope of the curve in Figure 5 is a function of the potential differential with respect to time and may be thought of as simi-

● **FIGURE 3. The clarification which results from first stage activated sludge treatment (middle beaker) is nearly the same as that from the second stage of treatment (right hand beaker). A sample of the raw domestic sewage is shown at the left.**

lar to the oxygen uptake slope produced by the polarographic determination of oxygen uptake in mixed liquors.[9] Here again there is one basic difference — polarography yields quantitative values; O.R.P. yields quantitative values. Also, polarographic determinations and calculations of D.O. and oxygen uptake are involved bench procedures not readily adaptable to the average plant or to automation, whereas O.R.P. is extremely adaptable.

The slope, or ratio of organisms to food, or ratio of oxidant to reductant may be readily changed by a knob adjustment in the air flow recorder/controller (or manually by adjusting the return sludge valve).

O.R.P. is the resultant of opposing forces of oxidant and reductant. The reductant is the BOD in effect, and the oxidant is composed of the molecular oxygen plus the oxidized products present. Thus the continuous measurement and recording of applied air reveals the oxygen demand of the admixture undergoing treatment and is, in effect, a continuous BOD determination.

Sludge Reactivation

There yet remains the function of the sludge re-activator or stabilizer and its control. Figures 1 and 5 portray various conditions of sludge loading. In the adsorption step of Figure 2, organic matter is transferred from the liquid to the sludge particle. This has the effect of increasing the ratio of reductant to oxidant and thereby increasing the potential difference or slope.

Following the separation step, this "loaded" sludge is transferred to the reactivation tank, where it undergoes aeration-detention. The transformations which ensue involve the synthesis of organic matter to organisms and concomitant transformation through metabolic activity, of decomposable organic matter to more stable oxidized forms.

Conclusion

Due regard for the ecological considerations in both the design and operation of sanitation facilities will ensure the requisite treatment results and will minimize aerial nuisance. The gathering weight of evidence shows that we can no longer afford to ignore O.R.P. in the design, management and operation of sanitation works.

It should be remembered that the academic background and origin of pH. did not prevent its wide acceptance and use in practice. As a matter of fact, the old accepted methylene blue relative stability test has an O.R.P. background! Methylene blue is a colorimetric O.R.P. indicator which decolorizes at plus 11 millivolts E_h, or zero dissolved oxygen.

Acknowledgments

This work was made possible by the active support and interest of the Commissioners of the Village of Ridgewood. Grateful acknowledgment is also extended to all those whose works have been quoted and referenced; and to those who have, along the way, participated in and contributed to the present isue of these endeavors.

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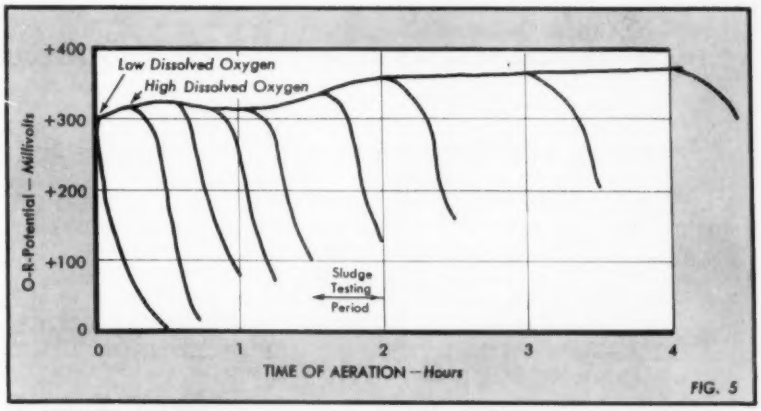


● **RESULTS of O.R.P. measurements on samples withdrawn from an aerating mixture, made at one-minute intervals for 30 minutes are represented as a family of vertical curves. Connection of the zero-time O.R.P. values represents a steady-state value.**

BASIC ELECTRICAL SYSTEM LAYOUT

BRUCE J. ENNIS
Principal Engineer,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

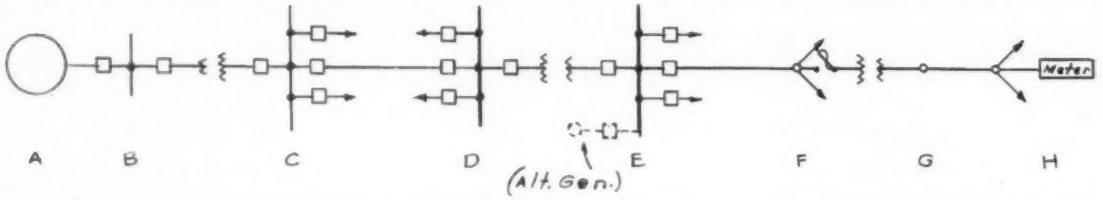
IN PLANNING for a new generation, transmission or distribution system improvement, it is often helpful to review certain basic electrical system principles to determine whether or not existing designs and layouts are satisfactory for the new addition, and whether or not the possibility exists for utilizing a better operating voltage or switchgear arrangement to meet specific requirements. In view of the complexity and diversification of individual systems, there are no hard and fast rules which are universally applicable; however, consideration of fundamental principles will frequently suggest a system design which will approach the optimum on the basis of economics and operations.

A typical electrical system employing overhead circuits is shown in Figure 1. In this diagram, representative voltages have been shown for generating units at "A"; for transmission lines between "C" and "D"; for primary distribution circuits between "E" and "F"; and so on. Based on commonly used conductor sizes and circuit lengths, a 2.4 kv circuit might be expected to carry from 1000 kva to 1500 kva, and at 13.8 kv, a circuit might be rated from 3500 kva to 10,000 kva, with corresponding ranges in capacity for the higher voltages.

Station usage in power plants generally runs from 4 percent to 8 percent for diesel plants, and from 6 percent to 10 percent for steam generating stations, depending on the type of auxiliary equipment used. Annual line losses for typical systems range from 7½ percent to 15 percent for urban distribution, and from 15 percent to 25 percent for rural distribution systems.

In Figure 2, the normal components of a typical underground sys-

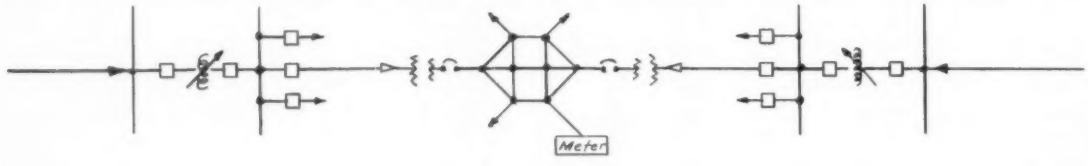
FIG. 1—TYPICAL ELECTRICAL SYSTEM USING OVERHEAD DISTRIBUTION CIRCUITS



Generation	Step-Up Substation	Transmission	Step-Down Distribution Substation	Primary Distribution	Step-Down Distribution Transformer	Secondary Distribution Service Drops
1000 KW to 1,000,000 KW	*1000 KW to 1,000,000 KW*		*300 KW to 10,000 KW (1000-5000 KW)*		*1½ KW to 100 KW (usually)*	
2.4 KV* 4.16 KV* 13.8 KV* 14.4 KV*		13.8 KV* 23 KV 34.5 KV* 46 KV 69 KV* 115 KV 138 KV* 161 KV* 196 KV 230 KV* 345 KV* 500 KV**		2.4 KV* 4.16 KV* 13.8 KV* 23 KV		120v. 1φ, 2w 120/240v. 1φ, 3w 240v. 3φ, 3w 480v. 3φ, 3w

*Preferred Voltages **Experimental Stage

FIG. 2—TYPICAL ELECTRICAL SYSTEM USING UNDERGROUND DISTRIBUTION CIRCUITS



Primary Feeder #1	Regulator Sub-Station #1	Underground Feeders	Trans. Vault.	Secondary Network Services	Trans. Vault.	Underground Feeders	Regulator Sub-Station #2	Primary Feeder #2
	1000 KW to 15,000 KW		*300 KW to 500 KW*		*300 KW to 500 KW*		*1000 KW to 15,000 KW*	
2.4 KV 4.16 KV 13.8 KV*		2.4 KV 4.16 KV 13.8 KV*		120/208 V*		2.4 KV 4.16 KV 13.8 KV		2.4 KV 4.16 KV 13.8 KV*

*Preferred Voltages

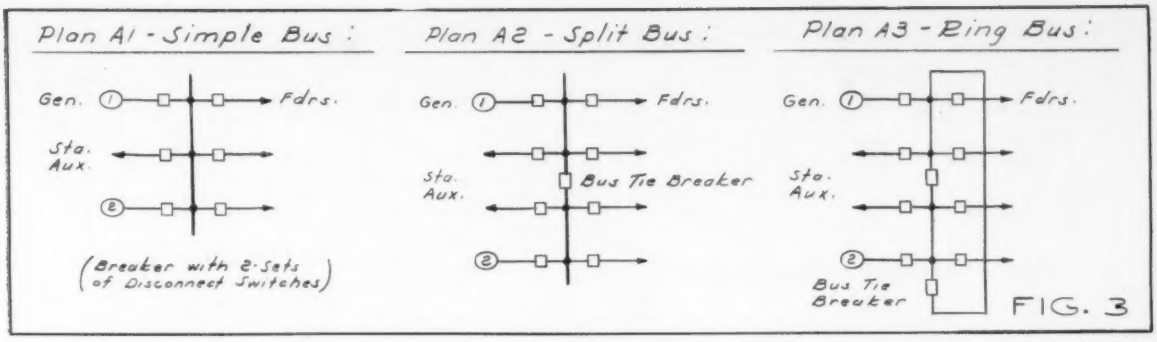


FIG. 3

tem are shown. For improved reliability, adjacent vault transformers are generally connected to underground cable feeders emanating from separate regulator station buses. In high load density areas such as in large office buildings, shopping centers, and industrial plants, the secondary network might be designed for operation at 277/480 volt operation, especially where the lighting load is of the 277 volt fluorescent type and motor loads are operated at 480 volts.

In Figures 3, 4, and 5, various plans are shown for switchgear layouts in generating stations which are suitable for the distribution of power to the electric system at the generated voltage level. In general, the characteristics, advantages, and disadvantages of the several layouts are as follows:

Plan A1—Simple Bus:

1. For small stations and industrial plants which can be shut down for maintenance of switchgear, for adding additional feeders, etc.
2. Least expensive
3. Least reliable

Plan A2—Split Bus:

1. Additional reliability for the small incremental expense of one bus tie breaker unit.
2. Circuits should be arranged for interconnection of feeders externally to the plant to permit maintenance of circuit breakers without an outage.

Plan A3—Ring Bus:

1. Essentially, this closes the ends of a split bus.
2. Greater reliability and flexibility of operations without greatly added expense.
3. The bus tie breakers may be maintained without opening the generator bus. Two or more generators may be kept synchronized during maintenance of a bus tie circuit breaker.

Plan A4—Transfer Bus:

1. Highly reliable system using single breakers at moderate expense.

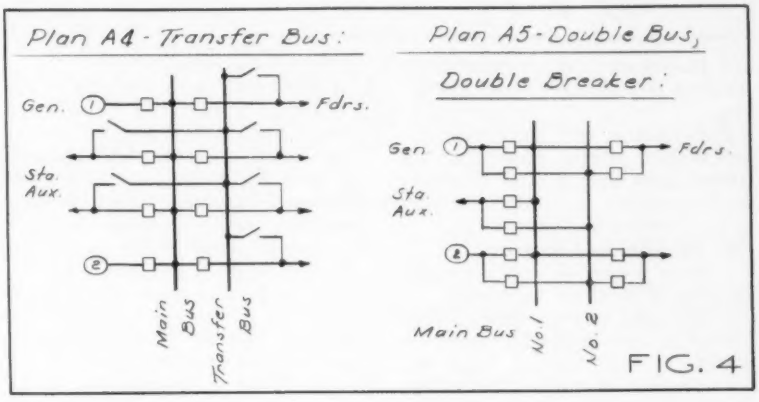


FIG. 4

2. Transfer bus permits maintenance of feeder circuit breakers without outages and without losing relay protection by utilization of a companion circuit breaker.

Plan A5—Double Bus. Double Breaker:

1. Most reliable
2. Most flexible for operations
3. Most expensive.
4. Permits outage free maintenance of generator and feeder circuit breakers, and feeders can be added without a shut-down.
5. Principally for large systems requiring an exceptionally high degree of service continuity.

Plan A6—Star Bus:

1. Permits economy in large systems by reducing circuit breaker interrupting capability requirements.
2. Helps reduce shock on systems under heavy fault conditions and prevents excessive damage to equipment.

Two typical layouts of switchgear for generating stations from which power is distributed at transmission voltage levels are shown in Figure 6, with characteristics as follows:

Plan B1—Combination Bus System:

1. Can be utilized for distribution of power at the generated voltage as well as at the transmission voltage level.
2. Station auxiliary power supply is very reliable.

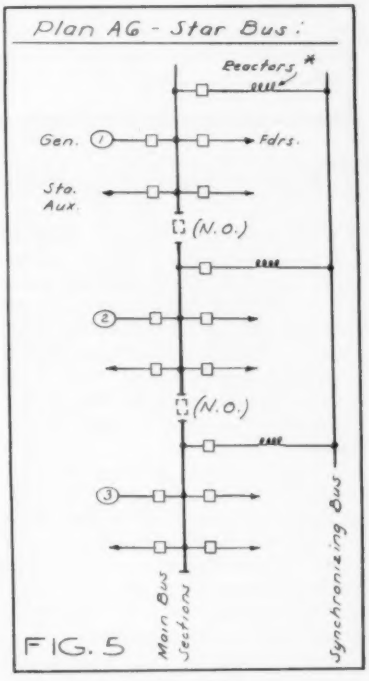


FIG. 5

***Current Limiting Reactors:**

1. **Bus Tie Reactors—5 to 10%**
2. **Feeder Reactors—3 to 5%**
3. **Generator reactors—3 to 5%**

3. Step up transformers serve as source of start-up power from interconnected plants.

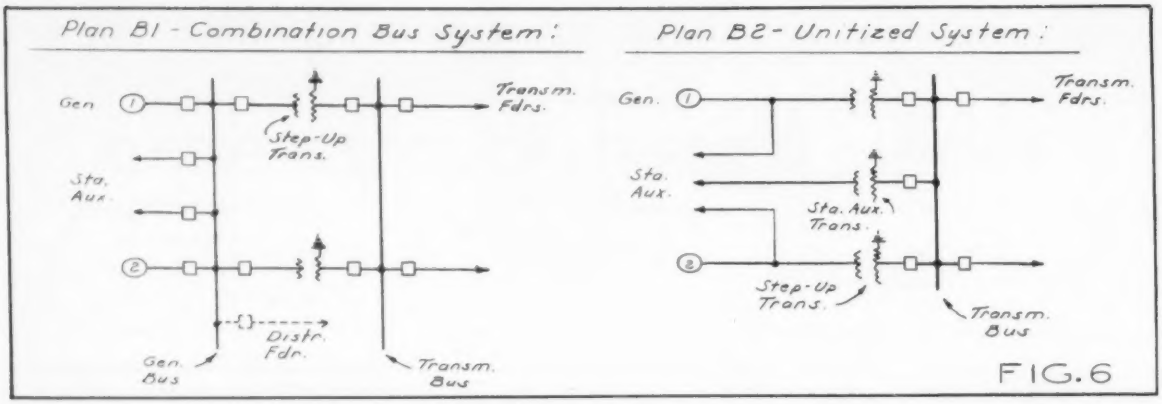


FIG. 6

4. Most expensive, requires large capacity low voltage circuit breakers.

5. Delta-wye step up transformers permit solidly grounding the transmission system and eliminate triple harmonic generated currents in the transmission system.

Plan B2—Unitized System:

1. Least expensive (no low voltage circuit breakers required).

2. Requires a step down transformer for station auxiliary start up power.

3. Simplest system for protective relaying.

4. Delta-wye step up transformers permit solidly grounding the transmission system and eliminate triple harmonic generated currents in the transmission system.

Certain principles applying to the grounding of generator neutrals are shown in Figures 7 and 8. Generators should never be solidly grounded as in Figure 7a, due to the possibility of abnormal damage to their windings under line-to-ground fault conditions (which would exceed the three phase fault currents).

For large generators, the neutral point tie is often made on the gounded side of a neutral circuit breaker as shown in Figure 7d. By so doing the extra expense of the neutral breaker is justified by the additional protection afforded the generator windings under fault conditions. By simultaneous tripping of the generator's main neutral and field breakers, the generator windings are opened and de-energized to reduce burning and damage.

From the preceding elementary switchgear layouts, it is apparent that many combinations are possible in the arrangement of substation buses. For example, the transfer bus scheme of Plan A4 in Figure 4 is quite often employed for the transmission bus in a unitized system shown in Plan B2 of Figure 6. The best overall electrical system layout for the individual system will depend on the desired maintenance, operational and protective functions weighed against an economic analysis of the various plans studied for a given system improvement program.

Power Pack Luminaire Cuts Installation Cost

USE OF a new General Electric Power Pack mercury vapor luminaire that eliminates the need for an external ballast and cuts in half the number of installation connections, has resulted in significant savings in a San Rafael, Calif., relighting project recently completed by Pacific Gas and Electric Company.

Since the area to be relighted was residential, it was necessary to provide an adequate level of illumination for safety and security while, at the same time, insuring against the long-standing complaint of "light in the bedroom window". Another consideration was economy.

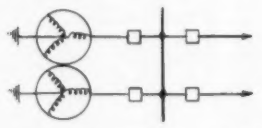
To guard against house-side glare, the luminaires were equipped with special shields which direct light onto the pavement. The maintained illumination is 1.3 footcandles.

To reduce the time required for the project, complete assembly of the luminaire, lamp, 12-foot bracket and power supply wiring through the bracket to the ballast terminal board was done on the ground. Then the integrated unit was hoisted into place and attached to existing wood poles.

Additional savings were made by use of existing 240-volt circuits instead of a multiple system which would have required higher material costs and separate external mountings of wiring and ballasts. Individual photoelectric control units were mounted in twistlock receptacles on the luminaires, thereby providing further savings in installation costs.

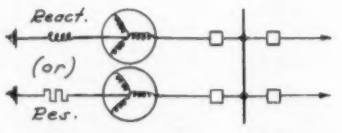
Fifty-four Power Pack luminaires are mounted 30 feet above the pavement on one side of the street at an average interval of 115 feet in accordance with the master street lighting plan worked out for San Rafael by Pacific Gas and Electric and approved by the City Council.

Electrical System Grounding:



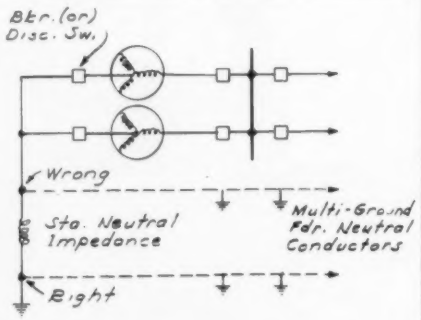
Solidly Grounded Gen.

Fig. 7a



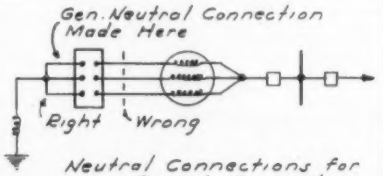
Impedance Grounded Gen.

Fig. 7b



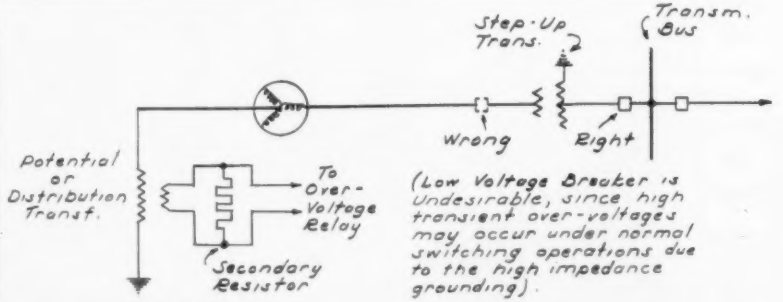
Station Gen. Neutral Grounding Impedance

Fig. 7c



Neutral Connections for Large Capacity Generators

Fig. 7d

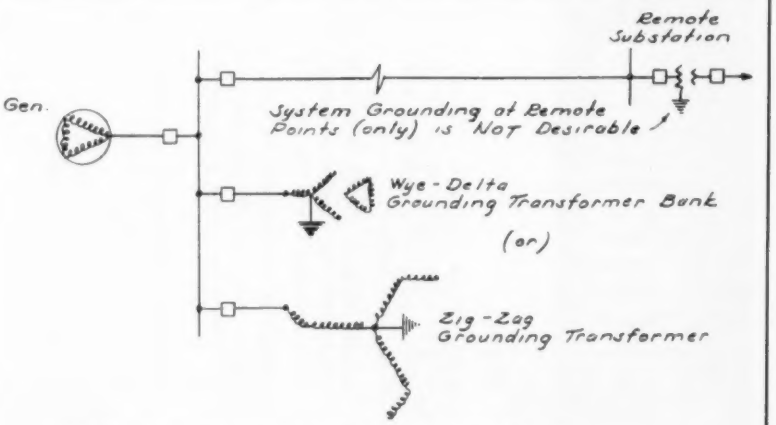


(Low Voltage Breaker is Undesirable, since high transient over-voltages may occur under normal switching operations due to the high impedance grounding).

Unit System Generator Grounding

Fig. 7e

FIG. 7



Grounding of Delta Connected Systems

Fig. 8a

Basic Fault Current Formulae:

Fault Current Type		"E" in Volts to Neutral, "Z" in Ohms		"I_{Base}" in Amperes, "Z" in PerCent
$I_{3\phi}$	=	$\frac{E}{Z_1}$	=	$\frac{100\, I_{Base}}{Z_1}$
$I_{(L-L)}$	=	$\frac{E}{\frac{Z_1+Z_2}{\sqrt{3}}}$	=	$\frac{100\, I_{Base}}{\frac{Z_1+Z_2}{\sqrt{3}}}$
$I_{(L-G)}$	=	$\frac{E}{\frac{Z_1+Z_2+Z_0}{3}+Z_N}$	=	$\frac{100\, I_{Base}}{\frac{Z_1+Z_2+Z_0}{3}+Z_N}$

For Grounded Neutral Lighting Arresters, $\frac{\Sigma X_0}{\Sigma X_1} = 3.0$ or less

For 3φ, 4W Distribution, $\frac{\Sigma X_0}{\Sigma X_1} = 2.0$ or less. (1.5 Recommended Max. Ratio)

FIG. 8

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Board Endorses Stand Against Advertising for Bids for Engineering Services

Chicago, Ill.—The Board of Directors of the Association, at its recent meeting in Chicago, endorsed the principle, set forth in the Code of Ethics of the American Society of Civil Engineers which reads, in part, as follows:

> "It shall be considered unprofessional and inconsistent with honorable and dignified bearing . . . to invite proposals for the performance of engineering services or to state a price for such services in response to any such invitation, when there are reasonable grounds for belief that price will be the prime consideration in the selection of the engineer."

Earl J. Thomson Chairs 1959 Resolutions Committee

Chicago, Ill.—President Hurst has appointed Earl J. Thomson, Consulting Engineer, Burns and McDonnell Engineering Company, Kansas City, Chairman of the 1959 Resolutions Committee. Members are Kenneth King, Director of Public Works, Phoenix, Arizona; Cletus E. Allen, Street Commissioner, Dubuque, Iowa; and John Lambie, County Engineer, Los Angeles. Members of APWA have the privilege of submitting to the Resolutions Committee items that they believe should be submitted to the membership for vote at the annual business meeting to record the official APWA attitude and recommendations on problems of importance to public works officials.

"Engineer of the Year"

Samuel S. Baxter (left), Water Commissioner for the City of Philadelphia, was named "Engineer of the Year" for Philadelphia, as reported in this column last month. Frank J. Myers, Vice President of the Pennsylvania Society of Professional Engineers, makes the presentation to Commissioner Baxter.

Another Sustaining Member

Chicago, Ill.—Number 34 on the list of APWA Sustaining Members is the Hobbs-Hydepak Division of Hobbs Trailers, Fort Worth, Texas, manufacturers of compactor type refuse collection bodies.

Specification for Soil-Bituminous Stabilized Base Course Available

Washington, D. C.—Harold F. Clemmer, Engineer of Materials and Standards, District of Columbia, and Chairman of the APWA Specification Committee on Soil Stabilization, recently reported completion of preparation of a specification on "Soil Bituminous Stabilized Base Course for Roads and Streets". The specification sets forth requirements for a base course composed of soil or a combination of soil and added mineral materials with liquid bituminous material. It outlines requirements for soil, liquid bituminous material, refers to methods of testing as specified by the American Society of Testing Materials, and sets forth construction requirements. The latter includes equipment, preparation of soil, application of bituminous materials, mixing, compaction and surface requirements. Guidelines for measurement and basis of payment are included.

A specification of the APWA is designed to assemble, in logical order, all of the basic material generally used in specifications and entrust to the person charged with the responsibility of issuing a specification for a particular job the responsibility of selecting the appropriate sections and paragraphs, with possible modifications to suit local conditions.

The specifications therefore are intended as a guide in the preparation of a specification to meet a particular situation, rather than a

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specification for general use. Members of the APWA committee on soil specifications include Wm. D. Monroe, City Engineer, Jackson, Michigan; Vernon C. Peebles, Chief Engineer, Raleigh, North Carolina; Carl C. Fagerlind, Commissioner of Streets, Waterloo, Iowa; E. H. Lindstrom, Assistant City Engineer, Seattle, Washington; Carl A. Distlehorst, Engineer-in-Charge, Street Construction, Dept. of Public Works, Milwaukee, Wisconsin and Reuben S. Rountree, Director of Public Works, Austin, Texas.

Copies of the 10 page specification may be obtained from the APWA, 1313 East 60th Street, Chicago, price $1.00; 60¢ to APWA members.

You Are Invited

Southeastern Public Works Conference
May 17-19, Gatlinburg, Tenn. (Murphy U. Snoderly, General Chairman, Box 8260, University Station, Knoxville, Tenn.)

New Orleans Chapter Meeting
May 6, New Orleans. (O. V. LeBlanc, Secretary-Treas., 6th Floor, Tulane Bldg., 3308 Tulane Ave., New Orleans 19, La.)

Chicago Chapter Meeting
May 21, Mid-West Country Club, Hinsdale, Ill. (Charles Sramek, 5040 W. Lawrence Ave., Chicago 30, Ill.)

Northern California Chapter Meeting
May 15, Oakland, Calif., (Lee J. Rothgery, Sec-Treas., U. C. Richmond Field Station, Richmond, Calif.)

Arizona Chapter Meeting
May 8 & 9, Williams, Ariz. (E. O'Neal Dye, Secy.-Treas., % City Hall, Tucson)

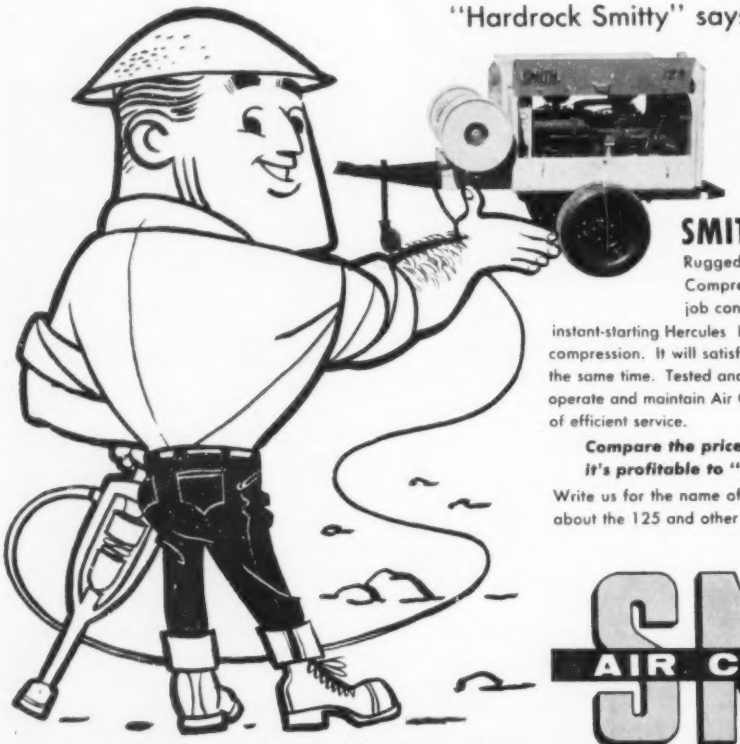
Ohio Chapter Meeting
May 7 & 8, Toledo, Ohio (Jack Unterburger, Secy.-Treas. % 510 Municipal Bldg., Dayton 2, Ohio)

Michigan Chapter Annual Conference
May 21, Lansing, Mich. (Richard L. Castle, Secy-Treas., 31600 Oak Park Blvd., Oak Park 37, Mich.)

New York-New Jersey Metropolitan Chapter Meeting
May 20, Clifton, N. J. (Elroy F. Spitzer, Secy., 470 Fourth Ave., New York 16, N. Y.)

Western Pennsylvania Chapter Meeting
May 22, Pittsburgh, Pa., (Joseph A. James, Corres. Secy., Institute of Local Government, University of Pittsburgh 13, Pa.)

Washington Chapter Meeting
June 9-10, Port Angeles, Wash. (Earl W. Elton, Secy.-Treas., City Engineer, City Hall, Bremerton, Wash.)



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Reshape roads now to restore proper crown and remove surface irregularities; add aggregate and binder soil as needed. Then treat with one pound of calcium chloride per square yard of road surface. Over the summer, one or two light "sweetening" applications of about one-half pound of calcium chloride per square yard assure you of smooth, compact, dust-free surfaces that cut maintenance costs year 'round. Add calcium chloride after the spring rains when moisture is still in the road surface.

On lightly traveled roads where traffic volume may not justify complete surface treatment, you'll find Columbia Calcium Chloride ideal for spot or strip treatment to bring about partial dust control and to prevent surface material loss. A 1½ pound per square yard treatment usually lasts the entire season.

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New England Chapter Meeting
May 22, Boston, Mass. (Bradford A. Clark, Secy.-Treas., 2 Ernest St., Providence, R. I.)

Wisconsin Chapter Meeting
May 21, Wisconsin Rapids. (John G. Thompson, Secy.-Treas., Room 115 City-County Bldg., Madison 9, Wisc.)

Missouri Chapter Meeting
June 5-6, Columbia, Mo. (W. R. Miller, Secy-Treas., Director of Public Works, Municipal Bldg., Columbia, Mo.)

• • •

Village Engineer Wanted

The Village of Bloomington, Minn., population 46,000, in the Minneapolis-St. Paul metropolitan area, is seeking a Village Engineer. The appointment will be made by the Village Manager under the Civil Service. Salary is open, starting up to $10,000. Minimum Qualifications: College degree in Civil Engineering and registration as a civil engineer in the State of residence. Successful applicant must become registered in the State of Minnesota within six months of appointment. Eight years of experience required as a civil engineer, three of which must have been in municipal work, preferably in a supervisory engineering position. For information or application write to Raymond T. Olsen, Village Manager, 10200 Penn Avenue South, Bloomington 20, Minnesota.

• • •

Broadened Licensing for Accelerated Sludge Digestion

Broadened licensing under its patents, of the use of the CRP Accelerated Sludge Digestion System, through the specification of consulting engineers with gas recirculation equipment supplied by approved and experienced manufacturers, has been announced by Chicago Pump Company. Information pertaining to the application of this system and license fees for its use in existing or new digesters designed for present or future maximum digested loadings, is included in this announcement.

The CRP Accelerated Sludge Digestion System, under United States Patent numbers 2,777,815 and 2,786,-025 incorporates gas recirculation in digestion tanks for high-rate digestion and is currently in operation or being installed in 43 installations. Eight of the plants are operating with digestion volume equivalent to from one-third to one-fifth past low-rate practice, or at approximately two-thirds cubic feet per capita.

Half of the plants incorporating the CRP Accelerated Sludge Digestion System utilize converted existing digesters for the System, and the remainder of the plants utilize new digestion tanks designed specifically for the CRP Accelerated Sludge Digestion System. A total of nine of the plant installations have been in operation in excess of three years. In all installations utilizing existing tanks, conversion to CRP eliminated needed digester construction, even though the units required expansion of capacity on the basis of low-rate design and operation practice.

The CRP Accelerated Sludge Digestion System is recommended for design loadings up to 0.2 pound of volatile solids per cubic foot of digestion volume per day, equivalent to primary digestion volume of 0.667 cubic foot per capita for complete treatment plants or 0.45 cubic foot per capita for primary treatment plants.

The gas recirculation apparatus utilized in conjunction with CRP Accelerated Sludge Digestion System is simple in design and in operation and easily installed in new or existing tanks. The equipment is

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Be cautious of signs that look like a good buy on the "flat" surface. Only embossed traffic-control signs and street-name assemblies by Miro-Flex have the durability to withstand the elements and abuse year after year. Miro-Flex signs are made on zinc-coated, Bonderized steel with baked-on enamel finish. Embossing gives them extra strength, rigidity, and legibility. A complete line of uniform signs conforming to Bureau of Public Roads standards and custom-designed signs are available. Send for free catalog and name of nearest source.

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■ Koontz Equipment Corporation, 325 Ohio River Blvd., Emsworth, Pittsburgh 2, Pennsylvania ■

No other filtering medium compares

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Anthrafilt stands alone
as the one Filtering Medium
that is best for all types of filters

Years of efficient and economical use in every type of filter plant has made ANTHRAFILT the standard of excellence in the filtering medium field.

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offers important advantages over sand and quartz

DOUBLES length of Filter runs • REQUIRES only half as much wash water • KEEPS Filters in service over longer periods • INCREASES Filter output with better quality effluent • GIVES better support to synthetic resins • PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, odor, etc. • IDEAL for industrial acid and alkaline solutions • EFFECTIVE filtration from entire bed • LESS coating, caking or balling with mud, lime, iron, or manganese.

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For further information, test samples, quotations and name of nearest distributor write:

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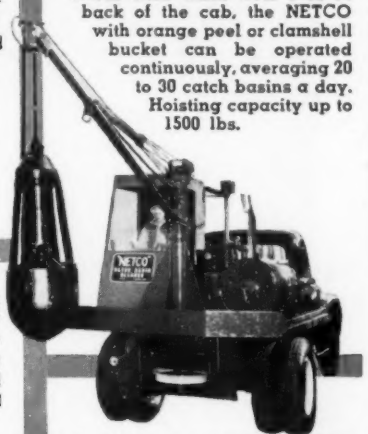
Easily mounted on any short wheel base truck with 8 ft. in back of the cab, the NETCO with orange peel or clamshell bucket can be operated continuously, averaging 20 to 30 catch basins a day. Hoisting capacity up to 1500 lbs.



NETCO does almost three times as many basins a day at less than half the cost per basin compared with old-fashioned manual methods.

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- Save 75% of your loading and hauling costs—4 Truckloads of brush equal 1 of chips.
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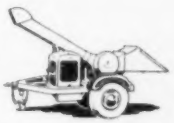
No wonder Asplundh Chippers are the fastest-selling, most often specified chipper on the market today. The fact that you can chip *more brush faster at less cost* with an Asplundh Chipper has been *proven* by the largest tree company in the world. It is by far the best chipper you can buy.

Write *today* for full details. Better—ask for a prompt demonstration without obligation.



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By Actual Test the Fastest Chipper Made

designed to maintain the primary digester in a homogeneous condition to assure proper conditions for sludge digestion and to eliminate transfer of undigested material to ultimate point of disposal. Scum and floating solids are non-existent under continuous operation of adequately engineered gas recirculation facilities.

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Curb and Gutter Paver Used on Detroit's Edsel Ford Expressway

THE W. G. Monte Contracting Co., Mt. Clemens, Mich., reported that they have been achieving production of 2000 linear feet of finished 9-in. high curb and gutter in a 9 hr. working day, on the Edsel Ford Expressway, undergoing extension in Detroit, Mich. The ready mix truck can dump its load between the curb forms with no waiting around, as the concrete is not run through the Dotmar paver.

Dotmar curb and gutter pavers have figured in the construction of many toll roads, throughways and expressways, as well as many regular state roads and city streets.

TIME

It's TIME to be thinking how you can **cut your litter collection costs;** TIME to **investigate and see** a demonstration of the **durable Tarco "Litter-Shark"** (in use over 2 years with no major part failure).

Picks Up: newspapers, paper wrappings, plates, and cups; milk cartons; **tin cans;** grass clippings and leaves.

Features: Heavy **all-steel suction impeller.** Replaceable stainless **steel suction case liner.** Bag carrying rack. Exclusive **Dust Control feature** (pat. applied for). Full castoring, load carrying third wheel.

Simplify your employees' job and minimize your litter problem. Write for your nearest dealer's name and have him demonstrate a "Shark" without obligation to you.

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ALL-STEEL SAFETY BARRICADE

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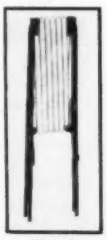

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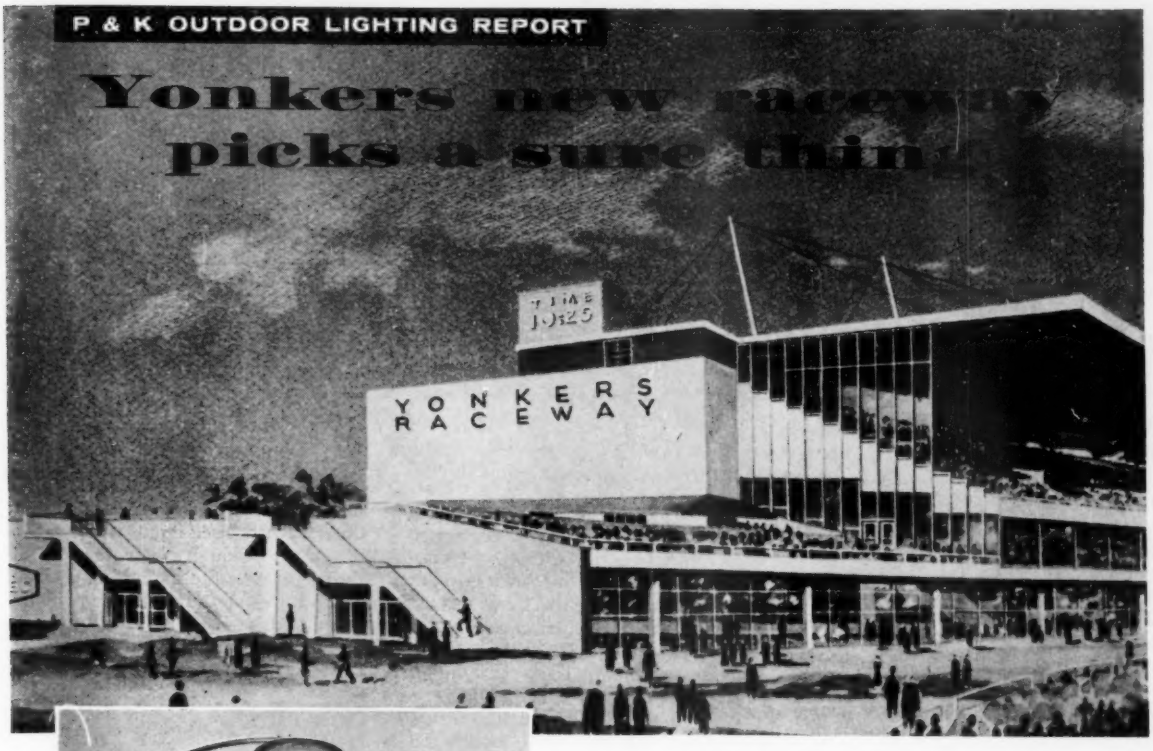
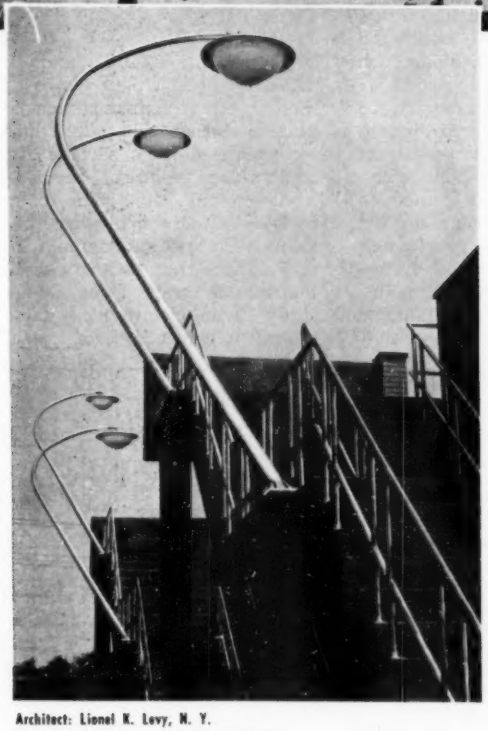
P & K OUTDOOR LIGHTING REPORT

Yonkers new raceway picks a sure thing





Architect: Lionel K. Levy, N. Y.
Electrical Consultant: Guy P. Panero, N. Y.
Electrical Contractor: Fischbach & Moore, Inc., N. Y.

P&K CIRCLElux DAVITS LIGHT THE WAY

Here, at the country's newest and most luxurious track, P&K all-aluminum CIRCLElux davit-style lighting standards were chosen. Their natural functional beauty add a modern complement to the surroundings. For example, the units illustrated are 10 foot gracefully arched davits with our CIRCLElux fluorescent luminaire. CIRCLElux incandescent luminaires were used in other applications at the raceway.

The wide range of styles available, along with the choice of three lighting sources—incandescent, fluorescent, and mercury vapor—enables you to effectively customize any installation with a "package" unit, standard and luminaire, complete and ready for installation. This means easier specifying and easier installation, and it is good to know that P&K aluminum standards never require painting or other costly maintenance, keep their good looks for years and years.

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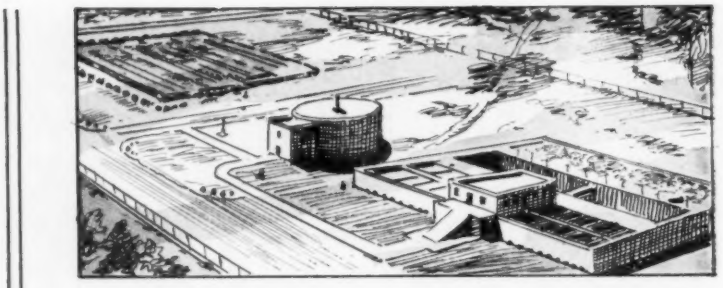
AND
REFUSE
DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Short-Term BOD

The standard 5-day BOD determination has one distinct disadvantage because of the relatively long period of incubation required, particularly when the BOD test is used for treatment control purposes. The authors report on some studies, using present BOD techniques, comparing the results of short-term BOD tests to those of the standard 5-day 20°C BOD test. It was concluded that for domestic raw and settled sewage: 1) The BOD incubation period can be shortened to 2 days without seriously affecting the reproducibility of the results. 2) The BOD incubation period can be shortened to 1 day and the results will be satisfactory for plant control purposes. 3) A short-term BOD test using an incubation temperature of 37°C has no better reproducibility than short-term tests at 20°C.

"Comparisons of Short-Term With 5-Day BOD Determinations of Raw Sewage." By H. E. Orford and F. E. Matusky. *Sewage and Industrial Wastes*, March, 1959.

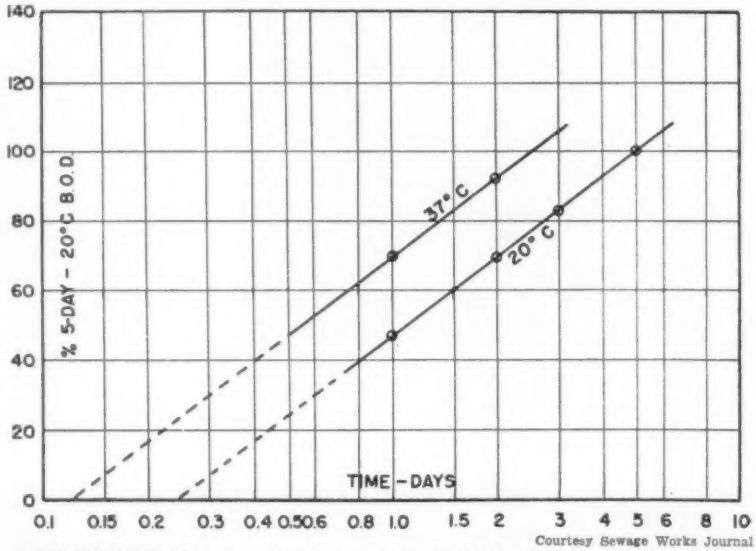
Reclaimed Water Factory

To provide adequate capacity to supply the water needs of the growing city of Amarillo, Texas, a sewage treatment plant was built which provides a high degree of treatment and at the same time a lucrative business through the sale of the effluent to a nearby petroleum refinery for use in their cooling towers, boilers and other steam processing functions. In 1954 after extensive investigations and negotiations, a mutual agreement was reached between the city and the Texas Company whereby the city would provide the proposed new refinery with a reclaimed sewage effluent suitable for most refinery uses. The basic provisions of the contract provided that: The City of Amarillo would construct a completely new 4.5 mgd sewage treatment plant, consisting of primary treatment, secondary activated sludge treatment, at least three days' storage of treated sewage effluent, reclaimed water pumping station and a transmission line from the sewage plant to the refinery. Figure 1 is a sketch of the Water Reclamation-Sewage Treatment Plant. The city was to provide a reclaimed sewage effluent with certain basic qualities agreed upon by both the city and the Texas Company. At the same time, the Texas Company would provide such additional treatment as required for its industrial uses. It would pay for the reclaimed sewage according to agreed stipulations in the contract which would retire the bonded indebtedness on 75 percent of the cost of the treatment plant and on 100 percent of the cost of the reclaimed water pumping station and transmission line. The Texas Company also agreed to pay for a minimum of 1.5 mgd of reclaimed sewage and was to have prior option on the entire 4.5 mgd daily output of the new treatment plant if so desired. This arrangement between the city and the Texas Company provides the industry with reclaimed water at a lower rate than fresh water and at the same time the dwindling underground water supplies are being conserved.

"Sewage Plant Effluent is Cheaper Than City Water." By C. H. Scherer. *Wastes Engineering*, March, 1959.

Corrosion Studies

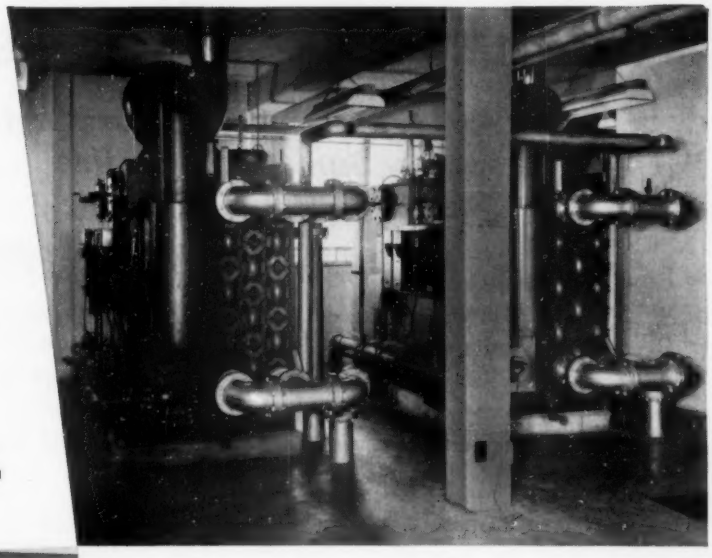
The Lukens Steel Company instituted a research program to determine the corrosion resistance of steel plate materials that might be used in "packaged-type" sewage disposal units. The technical service department of the steel company enlisted the cooperation of the Coatesville and Philadelphia Northeast sewage treatment works. These two plants were selected as the study would provide data on the corrosiveness of sanitary

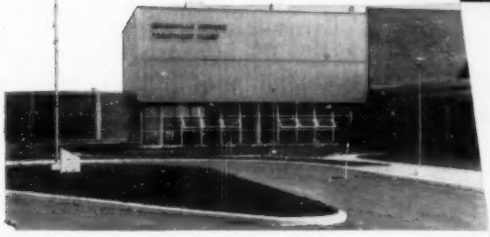


Courtesy Sewage Works Journal

● **RELATIONSHIP between short-time and standard 5-day BOD for domestic sewage.**

Evansville *Again* Selects P. F. T. Equipment.





ABOVE Efficient and economical digester heating is provided by these two P.F.T. #1000 Heaters and Heat Exchangers.

BELOW P.F.T. 75′ Floating Covers are installed on all four digesters.

Progressive, growth-minded Evansville, Indiana, has selected P.F.T. equipment for its *second* sewage treatment plant—the West Side Plant.

The citizens of Evansville are proud of their plant's modern architectural design and the contribution it plays in the Ohio River Restoration Program.

Equally proud is P.F.T. and the part we have played in having equipment in both the East Side Plant and now the new West Side Plant.

P.F.T. equipment includes: Four 75′ Floating Covers, two #1000 Digester Heaters and Heat Exchanger Units, four Liquidometer Cover Position Indicators, Supernatant Equipment and Gas Safety Equipment.

We'll be glad to send complete information on any of the equipment used in this installation.

Consoer, Townsend and Associates • Consulting Engineers, Chicago

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waste treatment equipment exclusively since 1893

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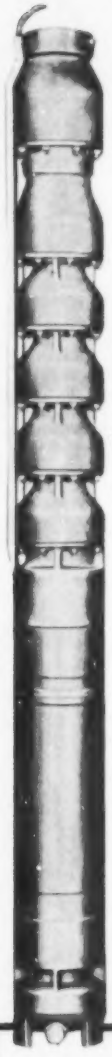
Best way to meet large scale pumping requirements



For water supply, choose and specify Sumo Submersible Deep Well Pumps

These electrically operated, high capacity pumps are installed directly in the well, completely under water. The entire installation is fast, neat and compact. Sumo Submersibles have been used in installations all over the world. They're completely dependable and designed to operate at highest efficiencies. Sizes from 1/3 hp to 120 hp with capacities up to 1500 gpm.

Engineering Assistance. Sumo's nationwide pumping experts are ready to assist you in problems of selection, application and installation. No obligation, of course.

BULLETIN B-1000 has complete details. Send for a copy.

For drainage, dewatering or flooding choose and specify Sumo Submersible Drainer Pumps These 7½ hp electric submersible drainer pumps are designed to pump water containing up to 20% solids. They're sturdy, reliable and can be used either as portable units or permanent installations. They're ideal for construction work, for dewatering mines, flooding compartments; pumping river or canal water.

BULLETIN B-1100 has details. Send for a copy.

SUMO PUMPS INC.

P.O. Box 983 Stamford, Conn.

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(Coatesville) and sanitary and light industrial (Philadelphia Northeast) sewage, as treated by the activated sludge process. The study included exposure of carbon steels A-285 and Digester; alloy steels Cor-Ten and T-1; and stainless steels Type 405, 430 and 304 in the primary, aeration, final settling and digestion tanks of both treatment plants. Details of the test procedures and the results are given in a number of tables. In general, the corrosion rates of the A-285, Digester, Cor-Ten T-1, Type 405, Type 430 and Type 304 steels indicate a possible application of these materials. Type 304 stainless steel appears entirely adequate while the chromium type stainless steels are somewhat susceptible to pitting. An economical combination of materials might be to use Type 304 stainless steel at the liquid line and splash zones and to use the carbon steels for the bottom and sides of the tanks which are completely and continuously submerged.

"Field Studies Probe Suitability of Steel Plate for Package Works." By A. Hoersch, Jr. and C. Wright, Jr. *Wastes Engineering*, March, 1959.

Units
Underground

An underground sewage treatment plant costing approximately $3.7 million is now under construction at Sydney, New South Wales, Australia. This new plant, designed to eliminate pollution from beaches adjacent to the Bondi sewage outfall, is due for completion in 1959. Serving an area of approximately 8,799 acres with a contributing population of nearly 302,000 persons, the Bondi outfall sewer has an average daily dry weather flow of 20.5 mg. The main outfall sewer is 8 ft. deep by 7½ ft. wide and is of oval origin at a depth of from 115 ft. to 150 ft. below the natural surface of the headland. The Bondi sewer had been constructed in a rock tunnel and the whole area of any treatment works had, therefore, also to be constructed by excavating in the rock. The design for excavations stipulates that the width of any tunnel should not exceed 30 ft. and the thickness of buttresses between main tunnels is to be not less than 24 ft. The design also provides for the interception of the existing 8½ ft. by 7½ ft. oviform brick-lined sewer by a concrete-lined diversion sewer to a junction chamber where electrically-operated penstocks will automatically control four branches to four parallel treatment lines. At the outlet ends of the four grit chambers, a common cross

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On your busy schedules you have dozens of hit-and-run assignments that require both a *lifting* machine, then *digging* machine. With one Hydrocrane you have both . . . *on the spot!* The Hydrocrane is a crane — lifts 12 tons. Five minutes later, it can be a clamshell. You simply swing around and pick up the bucket from the handy carrying rack, reeve the wire rope, and you're ready to dig in! Hydrocrane versatility saves you *both* time and money . . . lets you handle a bigger schedule with fewer machines.

Your Bucyrus-Erie distributor will give you all the facts. Ask him to prove them with a demonstration. Call him today or write Dept. 2A59A for free bulletin. Bucyrus-Erie Company, South Milwaukee, Wisconsin.

Feature for Feature— it fits your needs!

- **Hydrocranes mount on new or used commercial trucks, no special carriers needed.**
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- **Hydrocrane's telescoping boom lets you work in close quarters, or stretch out long for a big 70-ft. reach!**

The Hydrocrane's built-in carrying rack is designed to make attaching the clamshell quick and easy . . . a one-man job!

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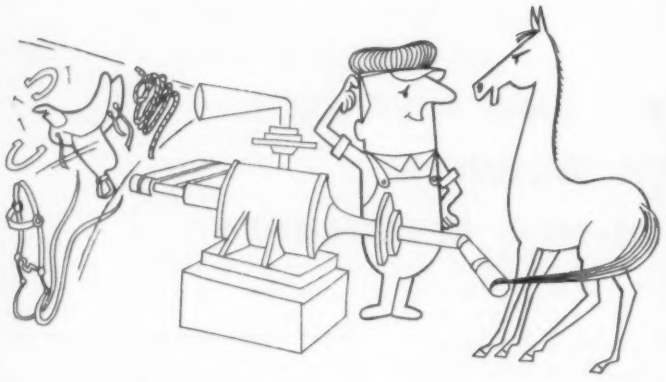
Over 50% of all Hydrocranes sold last year were REPEAT SALES!

WEMCO® the INCREDIBLE Torque-Flow Pump

pumps almost everything
(what will go in will come out)



secret: recessed impeller; continuous open passage
(maintenance a thing of the past)

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MOSQUITOES, FLIES AND OTHER INSECT PESTS
DESTROYED ON CONTACT

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TODD INSECTICIDAL FOG APPLICATOR

Lowest-Cost Space Control throughout the Community

On the dump, over pools, in suburbs, play areas, stockyards, TIFA gets the kill every time . . . at the lowest operating and maintenance cost. TIFA rapidly covers large areas with true clean fog, penetrates smallest crevices, envelops and destroys all insect pests. This efficiency with newest or older type insecticides, gives you a better insect control program for your community.

Carrying Underwriters' Listing Seal MH 4162
BEST by TEST for over 14 years in Community Fly and Mosquito Programs
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connecting channel leads to the four sedimentation tanks. The treated sewage is finally discharged to effluent channel and then via the existing submarine shaft to the ocean. Details are presented on the requirements and methods of construction of this unusual plant.

"Units Underground." By J. Grindrod. *Water and Sewage Works*, March, 1959.

Sewage Gas Engines

The author relates the experience of 22 years of operation of gas engines installed at the sewage treatment plant at Aurora, Illinois in 1936. Two 75-hp, 6 cylinder, type R6-I Climax engines were installed at that time and were provided with a Whitlock water-to-water exchange heater and an exhaust exchange heater, connected to the two 8-mgd pumps. They have been alternated every ten days thereby greatly contributing to the life of the pumps. The main crank shafts have been shimmed but never have been removed. When the engines were first operated, distilled water was used to avoid scaling. In 1943 the plant water supply was used after treatment with Calgon and no scaling has occurred since then. The problem of lubrication has always been given a great deal of consideration. The most troublesome and expensive problem connected with the Aurora engine installation revolved around the exhaust heat exchanger. This has been successfully solved by cutting down the length of the exchangers from 10 ft. to 6 ft. which increased the temperature in the exchanger from about 180° F to 280-290° F. After more than 22 years of operation the two pump engines have paid for themselves about 5 times and have earned over $65,000. Maintenance, supplies, auxiliary fuel and oil have averaged $679 annually per engine.

"22 Years of Experience with Sewage Gas Engines." By Walter A. Sperry. PUBLIC WORKS, April, 1959.

Trickling Filter Fundamentals

In sewage treatment by trickling filters, intimate contact between the sewage and the organisms which inhabit the slime on the trickling filter media is of paramount importance for successful biological oxidation. Consequently, the degree of oxidation obtained is related to the time of contact between the organisms and substrate. In this paper the authors have presented experimental data that have verified theoretical

SELECTED BY OMAHA...

C-E RAYMOND for sludge disposal

Omaha's expanded sewage treatment facilities will serve an equivalent population of 122,500 and will have an influent capacity of 12 mgd. Activated sludge filter cake from this modernized plant will be Flash Dried in a C-E Raymond Flash Drying and Incineration System, reducing it to even-size particles of uniform moisture content.

Selling this product for use as a soil conditioner and using it on municipal parks, lawns, and golf courses will help to defray plant operating expenses. The surplus can be burned to a sterile, clinker-free ash. C-E Raymond is the *only* system that permits both drying and incineration — separately or together — in any proportion.

High temperature deodorization and efficient fly ash collection here will assure that nearby residents are not annoyed by air pollution.

Controlled drying . . . efficient incineration . . . economy of operation . . . high temperature deodorizing and fly ash collecting equipment integral with the system . . . these are some of the reasons communities, large and small, throughout the country are choosing C-E Raymond.

For more information, contact the C-E office nearest you. Our specialists will be glad to discuss, with you or your consultants, how this system can benefit your community.

COMBUSTION ENGINEERING

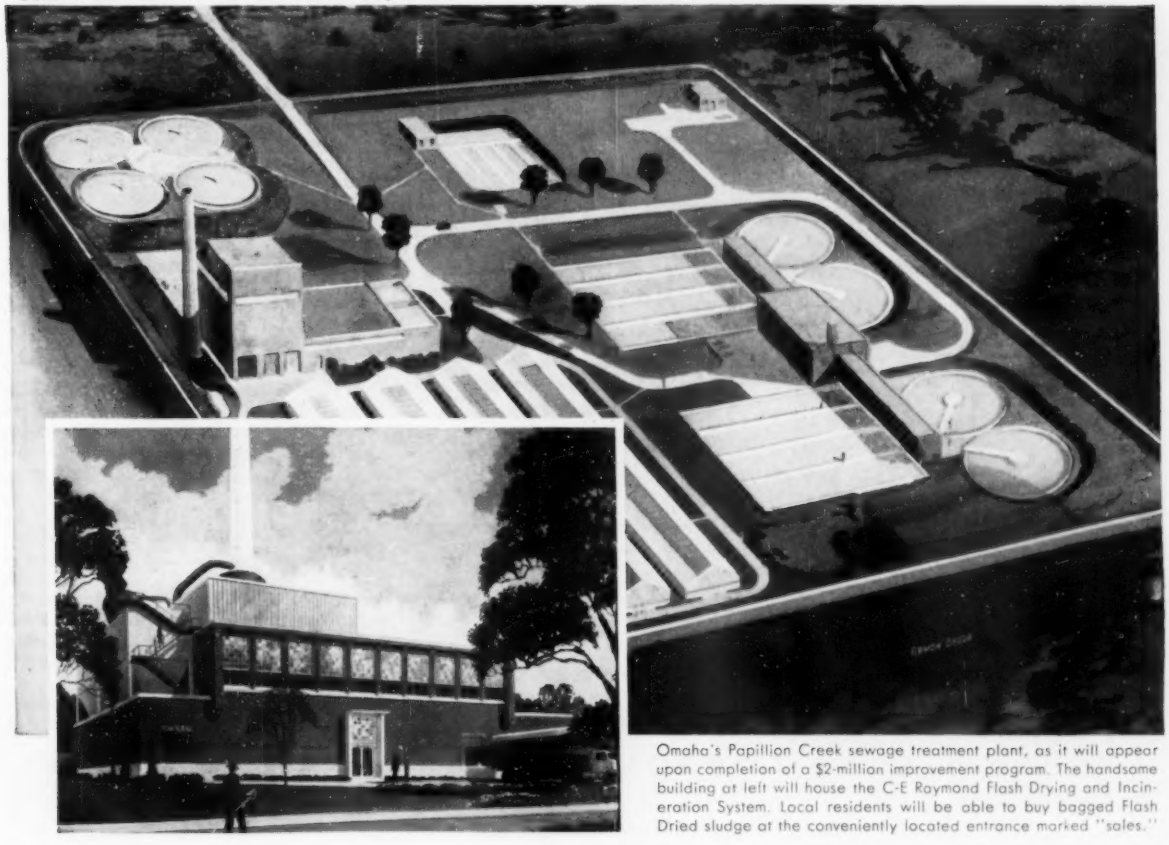
RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, New York 16, N. Y.
Western Office: 510 West Sixth Street, Los Angeles 14, Calif.
Canada: Combustion Engineering-Superheater Ltd.

C-179

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

Consulting Engineers: Henningson, Durham & Richardson, Omaha—Colorado Springs
General Contractor: Parsons Construction Co., Omaha



Omaha's Papillion Creek sewage treatment plant, as it will appear upon completion of a $2-million improvement program. The handsome building at left will house the C-E Raymond Flash Drying and Incineration System. Local residents will be able to buy bagged Flash Dried sludge at the conveniently located entrance marked "sales."

Big tool boxes hold full set of tools; fuel tank holds 8 hours' supply. Radiator shutters adjust to weather. Pneumatic tired retractable dolly is standard.

Jobs go smoother with a Jaeger Rotary

All users notice the difference. Jaeger's slower running speed (only 1700 rpm @ full load) consumes less fuel; better control holds pressure constant; air is 100° cooler than with old-type compressors; the machine is smoother, quieter, simple to operate, easy to move. Ask your Jaeger distributor to show you, or send for Catalog JCR8.

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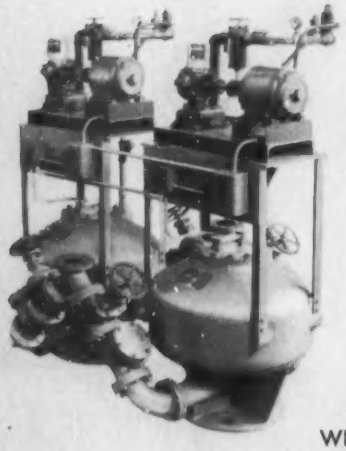

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equations relating contact time to application rates on trickling filters on an inclined plane and on a sphere. If the theoretical equations developed by Howland are assumed to be valid, the contact time of sewage flowing through a filter is inversely proportional to the 2/3 power of the application rate. The experimental results have also supported the theory whereby contact time on a sphere is directly proportional to the 5/3 power of the radius of the sphere. The studies have also shown that the amount of slime on a spherical filter media has very little effect on contact time, especially at high application rates. The implications of the reported results are that a deep filter containing the smallest practical media is to be preferred to obtain a given contact time at maximum efficiency.

"Fundamental Hydraulic Principles of Trickling Filters." By D. E. Bloodgood, G. H. Teletzke, and F. G. Pohland. *Sewage and Industrial Wastes*, March, 1959.

Other Articles

"Sewage Treatment-Behind Prison Walls." Inmate-operated Imhoff tank **trickling filter plant handles heavy overload** at "World's largest prison." By Bill Dye and Norm Mundt. Wastes Engineering, March, 1959.

"Non-Chemical Sewage Purification." Greeley, Colorado renovates and enlarges an old chemical-type sewage treatment plant. By R. H. Cruce. The American City, March, 1959.

"Sewer Cleaning by Contract" saves Army time and money at famous Fort Benning base. The American City, March, 1959.

"A Metropolitan County Organizes for **Storm Drain Maintenance."** Progress is being made in eliminating flooding which has occurred along various streams in Baltimore County, Maryland. By Robert J. Hajzyk. Public Works, April, 1959.

"The Next Step for Economy in Wastes Treatment." **Prefabricated media for trickling filters** may result in as many economies as did the acceptance of high rate filters. By R. L. Smith and H. C. Leibee. Public Works, April, 1959.

"Odor and Insect Control at an Open Landfill Operation." **Chemical applications solved insect and odor problems** at a riverfront landfill at Dobbs Ferry, N. Y. By Bart Paino and Chris E. Olsen. Public Works, April, 1959.

"The **Ontario Water Resources Program.**" The objective of the new legislation adopted recently in the Province of Ontario, Canada is an adequate supply of clean potable water to all communities. By A. E. Berry. Sewage and Industrial Wastes, March, 1959.

"Portable Stilling Well for Measurement of Weir Discharges." Construction details for a useful device. By T. P. Quirk. Public Works, April.

A County Engineer Looks At A Mobile Testing Laboratory

E. S. WARD,
Daviess County Highway Engineer, Washington, Indiana

This paper was presented at the Sixth Annual Highway Conference for County Engineers and Officials. The paper has been slightly condensed here.

AS WE all know, county highway officials live very close to the people and there is always a 100 percent greater demand for improvements than there is money to satisfy the demand, so that every dollar that is spent must produce at least a dollar's worth of transportation service, and any equipment, supplies, or services that do not help produce more and better miles with the money available are not purchased or used.

My experience has been that you need a sharper pencil, better information, better men and better equipment when you are working on a limited budget than you do when your funds are sufficient and quality is your one objective. I classify cost accounting, laboratory tests, and all the information necessary for intelligent purchasing as the tools of administration. That is, they furnish administration with the information necessary to make an accurate comparison of materials against costs, and allow a choice to be made between the best methods and materials available within the amount of the budget.

State Highway Departments today are designing and constructing their roads to meet the traffic condition that they expect to exist fifteen and twenty years from now. Most counties are aware of this practice and approve of it in principle, but do not have the money to design and build much beyond the present needs. By the time the surface is placed, the road is carrying more traffic than it was designed to carry and the result is high annual maintenance costs.

There are many economies that can be practiced by a County Highway Department with a thorough knowledge of their soils, and while the cut and try method of handling the soils will produce considerable improvement, it will not produce nearly the results that can be obtained by using the standard methods of soils testing for stability.

There is a close relationship between the various classes of soils and their stability when water or frost is involved. This condition can

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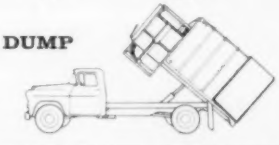

You'll collect more refuse per trip with Hobbs Hydepak, because it has three yards more *compressible* capacity than other refuse packers of comparable cost. Yet because of its advanced design and engineering, the Hobbs Hydepak weighs less – and can be installed on a lower-rated gross weight truck!

LOOK AT THIS COMPARISON:*

	Hobbs Hydepak Model 1619	Body G	Body P
Body Volume, cu. yds.	16.2	12.7	12.9
Empty Weight, lbs. (including weight of trucks)	12,180	13,740	12,280

*Measurements by an independent testing laboratory for a major Southwestern city.

Simple arithmetic shows you from the above how four Hobbs Hydepaks can do the work of five other units of similar weight and cost. You save the cost of an entire unit, crew, fuel, maintenance and insurance – *and* you reduce costly trips to the dump site!

HYDEPAK is a division of HOBBS TRAILERS, leading manufacturer of truck-trailers and bodies

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MORE CAPACITY, EFFICIENCY WITH HOBBS HYDEPAK

often be improved by blending soils that are right on the job, and this manner economize on the amount of granular material needed that may have to be hauled in from several miles away. Soils are so variable that it is usually desirable to make a few check tests during construction.

Occasionally, two roads quite close together, or often parts of the same job, have soils that can be blended to the advantage of the different soils. For instance, one part of the job may be sand while the other part is clay, and by taking some of the sand and mixing with the top of the clay grade and some of the clay, and mixing it into the top of the sand, both jobs are improved. If the granular material for the base has the usual haul, you have saved considerable money by doing it. It is desirable, however, to have tests run to determine the proper percentages of each soil to use.

When a county sends its samples away to have them tested at a commercial laboratory or at the University or Highway Department, there is a delay, or the test results come too late, so that part of the job may already be completed without the information that the test is designed to produce.

Much of the asphalt comes to the job in tank cars or transport trucks. You can't afford to pay demurrage on the tank car or hold the truck until you get the result of the test; if the weather is good you go ahead and hope the report is clear when it comes.

State Highway Departments have been very cooperative with the County Highway Departments in the past, and will no doubt do so to the best of their ability in the future. But, with this expanded road program which all the states are entering into for the next fifteen years, the soils and materials testing departments are working overtime to get out their own tests. So, it looks as though it is up to the County Highway Departments to get busy, get the knowledge and tools, and do the work themselves.

I am very much in favor of this because when the state makes a test for the county, it is used on that job and that is the end of it. But if the county men learn to do the testing themselves, they will understand what the test means and they will apply it to all their work, both construction and maintenance. They will have pride in their work and the county will have better roads at no additional cost.

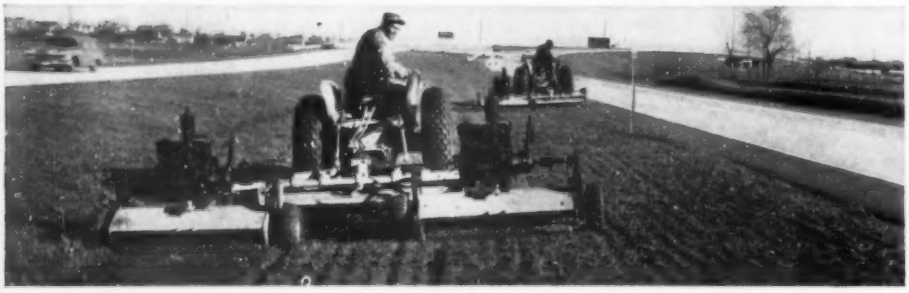
Building Management Costs in New York City

The cost of maintaining and operating public buildings under the jurisdiction of the New York City Department of Public Works during the fiscal year 1957-58, aggregated $1.090 per sq. ft. The total area was 7,314,638 sq. ft. Cleaning was the principal item and this was held to 39 cents per sq. ft. Other costs, on the same basis, were: Supervision 6½ cents; watchman service 3.8 cents; heating and ventilating 24.4 cents; elevator operation 12.2 cents and maintenance 4.1 cents; electrical maintenance 2.2 cents; painting 3.2 cents; plumbing 1.6 cents; general services 5.3 cents; equipment and furnishings 0.5 cent; and structural maintenance and alterations 6.2 cents.

Custodial supervision of buildings is graded by square foot floor areas with a Senior Building Custodian in charge of buildings with over 100,000 sq. ft., a Building Custodian for those having between 50,000 and 100,000 sq. ft., and an Assistant Custodian in charge of those with less than 50,000 sq. ft.

Frederick H. Zurmuhlen, PE, RA, is New York City Commissioner of Public Works.

A new concept for **safe**
HIGHWAY MOWING!



MOTT Hammer-Knife mowers! One mower for all hi-way mowing jobs . . . rough or smooth—grass or weeds—wet or dry! The in-line cutting action is in the direction of travel. It cuts evenly—without scalping—through ditches, over banks and along roadways. The unique flail-type cutting action deflects the shredded clippings to the ground—not even a blade of grass is tossed sideways. There's no danger of flying sticks, stones and other debris. MOTT *is* safe . . . safe to operator and safe to passing traffic.

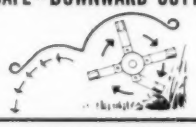
Dual Economy . . .

MOTT is low in operating costs and maintenance cost. Proven in actual use to stand up under the most rugged hi-way mowing conditions. The free-swinging knives can be sharpened repeatedly and eventually replaced at dime store prices. 32 models from 18 in. to 19 ft. New type 13 ft. convertible gang hitch shown. Also available in standard rear or underslung mountings—4, 5 or 6 ft. widths.

We invite you to try the MOTT Hammer-Knife mower under your own mowing conditions—then compare! Seeing is believing. See your local dealer—or write for complete literature.

EVEN CUT ON ALL TERRAIN

SAFE--DOWNWARD CUTTING



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...Packed with Operating "Extras"

There's no mistaking this new Trojan 124 — a standout performer in any task force, on any job . . . This is the 1½ cu. yd. tractor shovel that you have been asking for . . . The new job-rated Trojan proudly presents an imposing combination of extra operating benefits that can only spell P-R-O-F-I-T to the user.

At no extra cost Trojan offers the safety and greater visibility made possible by Trojan's *patented safety curve arms,* a favorite with tractor shovel operators . . . the maximum stability provided by wide-tread tires . . . 10,000 lbs. rated lifting capacity, highest for any machine of this size . . . greater carrying capacity . . . 40° bucket tip back at carry position . . . full power shift transmission . . . a variety of bucket sizes from 1½ to 2 cubic yards . . . choice of gas or diesel power . . . plus the widely preferred Trojan features that insure low-cost, efficient production on so many jobs today!

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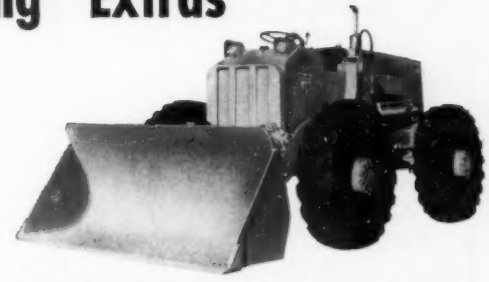

Take full advantage of the variety of applications your Trojan 124 can offer, and all other Trojan models as well, with such quick-change attachments as pallet forks, backhoe, snow plow, dozer blade, crane hook and special buckets.

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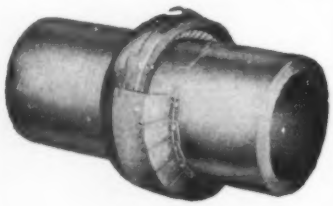

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Costs of Operation of Road Machinery and Police Cars

RECORDS are kept by Bensalem Township, Bucks County, Pa., on the cost of operation of its mobile equipment. As reported to us by William A. Sommers, the costs cover a full year for three motor trucks, a roller, a tractor and a grader; for the police cars, costs cover a full year for car 21 and the March to December period for cars 17-20, which were purchased in March, 1958. Table I gives complete data on the police cars.

The three motor trucks were purchased in 1953 and are now fully depreciated. The cost is stated on the per mile basis, as are the costs for the police cars. Table 2 gives the cost figures on the trucks.

The roller, which is 10-ton, is also

Table 1—Cost Figures on Police Cars, 1958

Car Numbers	*17*	*18*	*19*	*20*	*21*
Gasoline	$ 712.08	$ 854.62	$ 855.12	$ 822.67	$ 249.83
Oil	51.08	58.94	42.95	48.21	9.65
Tires & Others	122.77	154.31	169.40	134.15	117.87
Wash. & Greasing	48.30	64.20	57.10	71.90	15.75
Repair Labor	255.81	288.92	191.86	262.95	139.94
Repair Parts	198.08	101.07	234.94	160.84	176.44
Other	52.47	22.55	24.65	21.90	8.80
Insurance	220.60	208.00	208.00	208.00	220.60
Depreciation	725.00	725.00	725.00	725.00	720.00
Totals	$2386.19	$2477.61	$2509.02	$2455.62	$1658.88
Mileage	31,633	37,097	32,975	33,803	16,624
Cost/mile without depreciation	5.2¢	4.7¢	5.4¢	5.1¢	5.6¢
Cost/mile with depreciation*	7.5¢	6.7¢	7.6¢	7.2¢	10¢

*Depreciation based on 2 yrs. @ $1450; No. 21 depreciated on 3 yrs. @ $2160

Table 2—Cost Figures on Road Trucks, 1958

Truck Numbers	*1*	*2*	*3*	*Pickup*
Gasoline	$ 348.50	$ 370.64	$ 375.82	$179.84
Oil	11.48	21.70	20.22	4.20
Tires & Other	42.20			60.29
Wash. & Greasing	15.55	19.35	14.00	2.10
Repair Labor	778.02	465.61	534.61	282.57
Repair Parts	350.81	219.21	129.09	7.60
Other	15.00	39.40	47.69	8.90
Insurance	109.95	109.95	109.95	92.95
Depreciation		(Fully Depreciated)		
Totals	$1671.51	$1245.86	$1231.38	$638.45
Mileage	11,565	12,532	13,556	11,282
Cost/mile fully depreciated	14.4¢	9.9¢	9.0¢	5.6¢

Table 3—Cost Figures on Road Equipment, 1958

Equipment	*Roller*	*Tractor*	*Grader*
Gasoline	$109.36	$ 69.19	$ 103.19
Oil	7.74	3.26	1.68
Tires & Other	27.40		
Wash. & Greasing	8.90	21.47	1.65
Repair Labor	24.75	8.30	94.10
Repair Parts	97.35	5.40	203.92
Other	3.75	34.15	166.68
Insurance	108.53	108.53	108.53
Depreciation	(Fully Dep)	541.00	851.00
Totals	$387.78	$791.30	$1530.75
Cost/month without depreciation	$32.31/mo.	$20.85/mo.	$56.23/mo.
Cost/month with 10 yr. depreciation		$66.00/mo.	$127.56/mo.

fully depreciated; the tractor and grader were purchased in 1957 and are depreciated on a 10-year basis. Because neither mileage nor accurate hourly use records are available, the cost of these three units was computed on a monthly basis. Table 3 gives the cost data on the roller, tractor and grader.

• • •

Lima Roadpacker Handles Tough Compaction Problem

The job of packing the sand subbase for a 65,000 sq. ft. paved launching site for Nike anti-aircraft missiles at Selfridge Air Force Base, near Detroit, Mich., proved to be one of the toughest compaction jobs a paving contractor could face.

Eighty-five percent of the sand was finer than 200 mesh although only one percent of it was clay. Yet, it had to be compacted to a specified density of 95 percent of modified Proctor.

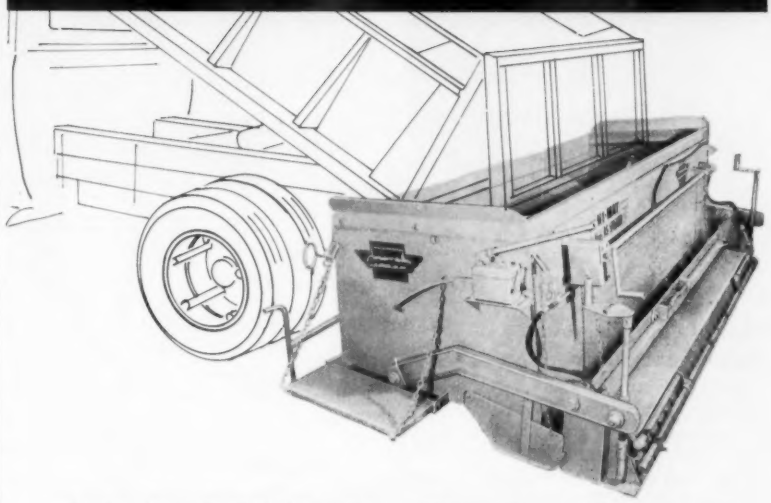
The contractor, Stolaruk Asphalt Paving Co., Oak Park, Mich., had a $55,000 sub-contract as part of a $278,000 contract awarded by the Detroit District Army Corps of Engineers.

The Roadpacker, built by the Lima Works, Lima, Ohio, of Baldwin-Lima-Hamilton Corp., a self-propelled unit specifically designed to compact granular roadbuilding materials, was bought to compact the sand. It is equipped with six 420-pound vibrating shoes that oscillate vertically about ¼-inch at the frequency best suited to the base material. Frequency is controlled by the operator.

The sled-like shoes are actuated and controlled hydraulically. Hydraulic operation of the shoes permits the system to be sealed so the machine will operate at full efficiency even if the vibrating shoes are completely covered by sand. The unit works in either forward or reverse, eliminating the need for turning the machine around at the end of each pass.

The specification for the Nike launching sites required the contractor to lay two six-inch layers of granular fill over a clay and sand subgrade. After some 3500 yards of sand were laid, about 2700 yards of stabilized road gravel were used to build a third six-inch layer, giving a total sub-base depth of 18 inches. The gravel had to be packed to a density of 100 percent of modified Proctor, or better. The Roadpacker was used to compact both the sand and the gravel.

HI-WAY Model AS Bituminous Paver

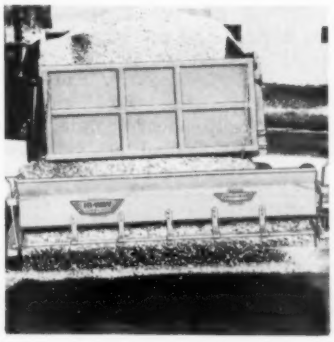


A Jack of All Trades, Tow-Type Paver... a Running Mate for your Self-Propelled Equipment

A fast worker on driveways—parking lots—playgrounds—airports—streets, roads and highways—and on any job you can drive a truck through. A paver small contractors and townships alike, can easily afford. Adjustable full floating screed permits concave surfaces up to 1½" crown. An optional heated screed permits paving with hot or cold mixes. Hydraulically operated spring-loaded shutoff gate eliminates emptying at end of the run. Can also be used to spread aggregates.

Other Model AS Features

- *Screed raised, lowered or locked in road-traveling position by hand crank*
- *Available in 8, 9 and 10′ widths with capacities up to 1⅓ cu. yd.*
- *10 gauge, reinforced hopper with smooth sloping sides*
- *Folding type operator's platform on each side of paver*



Handles All Aggregates from Sand to Crushed Rock

Model R Seal Coater

Available in 6 widths from 8 to 13′, with capacities up to 1.6 cu. yds. Adjustable feedgate levers at both ends of Model R permit tapered spreads. Feedgate follows a true arc when opening or closing, no free-flowing of material. Forward and reverse transmission controlled by a single lever.

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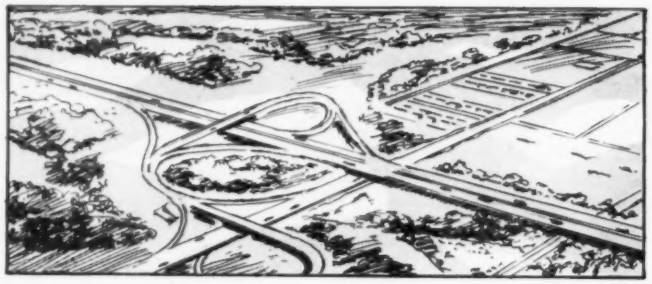


Prepared by **FRANK FORCE,** *Associate Editor*

County Builds Highway Maintenance Garage

Henry County, Ohio, bought a 5.75-acre tract of land in 1943 for a maintenance garage. In 1954 a steel storage building was erected which was 36 ft. wide and 82 ft. 10 ins. long. By 1957, additional facilities were required and a new building with two coordinated but separate operating areas was conceived. One area of the building, 74 x 160 ft., was designed for unobstructed interior vehicular storage, with drive-through facilities. The other, 40 x 120 ft. was designed to house all other related activities. The operating area of the building is connected to the storage area along the 120-ft. common wall. This area contains the boiler room, locker and restroom, paint room, tool room, mechanics parts room, office and a repair room. The repair shop is equipped with a truck hoist and an under-floor motor-exhaust system. The heating system is hot water and has a natural-gas-fired boiler. The structure has a steel frame. The bottom 4-ft. of all exterior walls is of reinforced portland-cement concrete. Brick-faced masonry extends to the top of the windows and the upper part of the walls are constructed with color-coated insulated metal wall panels. The roof consists of a zinc-coated steel deck. The 20-year built-up roof is supported on open-web joists.

"Ohio County Builds Highway Maintenance Garage." By Lynn J. Walker, Henry County Engineer, Napoleon, Ohio. *Better Roads*, March, 1959.

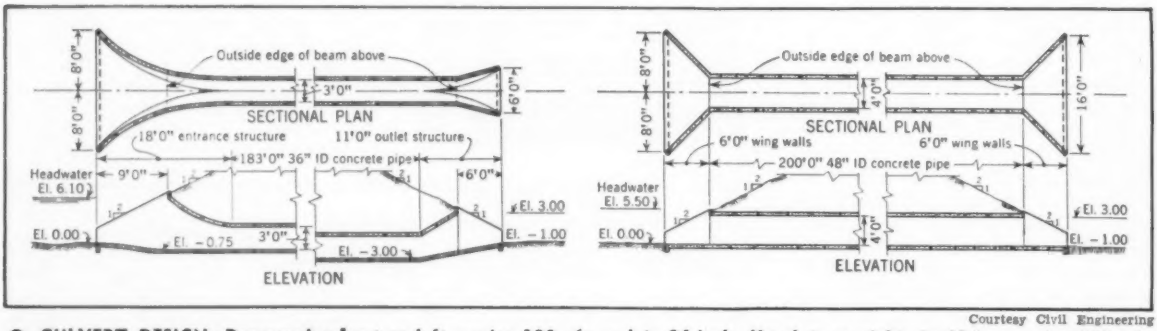
Culvert Performance Through Design and Research

Improving culvert performance by reducing energy losses at the entrance, in the barrel, and at the outlet, is the aim of engineers conducting design and research studies on culverts. Such reductions make it possible not only to increase culvert capacity but also to decrease erosion downstream from the culvert. Potential savings in construction cost, it is expected, will be enormously more than the outlay for the engineering and research required to attain them. The fundamental concepts of accelerating flow through, and of recovering kinetic energy at the end of, a closed conduit or open channel is not new. They have often been applied in the design of inverted siphons and diversion tunnels. One of the latter (Box Canyon Project, Pend Oreille, Washington) was designed by the writer, and the model was studied at the St. Anthony Falls Laboratory. The model demonstrated the transition from supercritical to subcritical flow in an open channel without a jump. About 8 ft. of velocity head was recovered at the design discharge.

"Improved Culvert Performance Through Design and Research Studies." By William J. Bauer, Consulting Engineer, Chicago, Ill. *Civil Engineering*, March, 1959.

Seal Coats for County Roads

Contra Costa County, California, has just completed over 100 miles of double seal coating at 12¼¢ psy. The seal coat train consists of self-propelled chip spreader, two 1000-gal. oil distributors, a pneumatic tired roller, two steel rollers and a fleet of rented trucks. The chip spreader follows immediately behind the distributors and the three rollers follow the chip spreader. In open country a rate of application of 3½ miles per day has been attained and the season average is 2.02 miles. The asphalt used is a penetration type emulsion and is delivered at a temperature of 130°F which contributes to the uniformity of the oil spray operation. The mineral aggregate is hauled from stockpile sites, or depending on the location, directly from the quarry to the chip spreader in 10-yd. dump trucks. The double seal provides a small amount of additional strength, it discourages entrance of water into base material of low "R" value and it helps keep an integral surface,



Courtesy Civil Engineering

● **CULVERT DESIGN: Depressed culvert at left carries 100 cfs and is 36-inch. Usual type, right, is 48-in., carries 100 cfs.**

THE LINE RIDER AND HIS GANG of Diamond Chemical killers are the most inexpensive hirelings you can find for rubbing out weeds and brush. Back in Ohio they saved their bosses $18.75 per highway mile per season.

Meet the gang:

FOR MIXED BRUSH—LINE RIDER LV-3D/3T, a 2-Ethyl Hexyl Ester formulation of 2,4-D and 2,4,5-T containing 3 pounds each of acid equivalent per gallon.

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FOR SPECIAL CONDITIONS—Also available are other standard LINE RIDER formulations, including Butyl and Low Volatile Esters of 2,4-D and 2,4,5-T containing 4 pounds acid equivalent per gallon.

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thereby reducing routine patching operations. A double seal coat on a farm-to-market type of road has a service life of from 4 to 7 to 8 years and during its life requires very little maintenance.

"Double Seal Coat for Primary and Secondary Roads." By Donald D. Chamberlin, Assistant Public Works Director, Maintenance Div., Contra Costa County, Martinez, Calif. PUBLIC WORKS, April, 1959.

Tire Recapping Program

The Texas Highway Dept. has nearly 11,000 pieces of major equipment with an inventory of over 50,000 tires. If tire requirements of minor equipment such as trailers, compressors, paint stripers and road rollers also are counted, a total of 75,000 tires is tabulated. There are ten to fifteen thousand tires replaced each year. Simple mathematics revealed that increasing new tire costs for graders and trucks in the Department demanded some kind of economy measure. The average recap for a worn truck tire would cost $20, a saving of 60 percent when considered against the $50 needed for a new replacement. A traveling representative from the Central Office was sent to all District Offices to promote preventive maintenance of tires. In his visits he informed equipment men that when the original tread was worn down, there still remained in the cord body 70 percent of the total cost of the tire. Because a nylon-cord body will take two or more successful recaps, Equipment and Procurement Division has secured approval from the State Board of Control for the Highway Department to specify, where available, all-nylon-cord body construction, not only on all contract replacement tires but on tires which outfit new major equipment. Shops near the District warehouses gave discount rates to the department for their recapping jobs.

"Tire Recapping Program." *Texas Highways*, March, 1959.

Reinforcement of Concrete Roads

There are five separate factors producing stresses in highway concrete, and cracking is usually caused by a combination of two or more of these. They are wheel loading, shrinkage of concrete, thermal movements, thermal gradients and moisture gradients. Experience has shown that fine hair cracks will not impair the performance or riding quality of a road, and the use of reinforcement will prevent these surface cracks from deteriorating and

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9:20 Cover-stone is spread

9:25 Tandem rolling of cover-stone

"Flusher" test proves...

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Recently, we announced the availability of a new product:

CATIONIC BITUMULS.

We talked of adaptability to "difficult" aggregate; rapid set; resistance to early rains.

Since then, we have put this new material to many rigorous tests on actual jobs all over the country. We needed rain to show, dramatically, how Cationic Bitumuls protected new paving and surfacing against sudden showers. When we couldn't **get** rain we **made it!**

CONSTRUCTION DATA:

On a very revealing test in Long Beach, California, for instance, we used a street-flusher to simulate heavy rain. On 1,100 ft. of 72-ft. wide street pavement, various sections were blocked out to provide "control" testing. These sections were "shot" with both regular grades and Cationic Bitumuls; were covered and rolled in rapid sequence. **Within 15 minutes after application of the binder,** the street flusher (as shown above) "watered" these sections with the equivalent of a heavy rain. The sections were then opened to traffic.

RESULTS:

The sections sealed with Cationic Bitumuls retained practically all cover-stone. As expected, the regular grade of emulsified asphalt "washed-out" under this severe test and most of the stone was lost under early traffic.

Many years of research, testing and development work have gone into the production of Cationic Bitumuls. This product offers two distinct advantages to the road building and pavement maintenance industries: it coats almost **all** aggregates, even those usually regarded as "difficult"; and it extends the normal working season.

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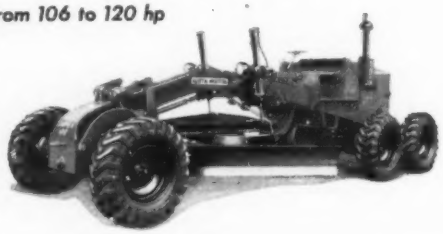

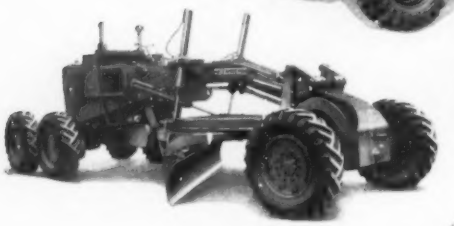

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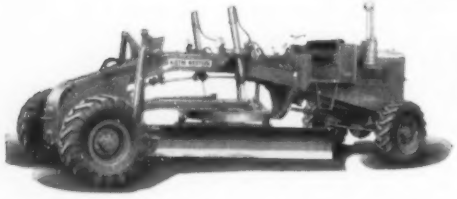

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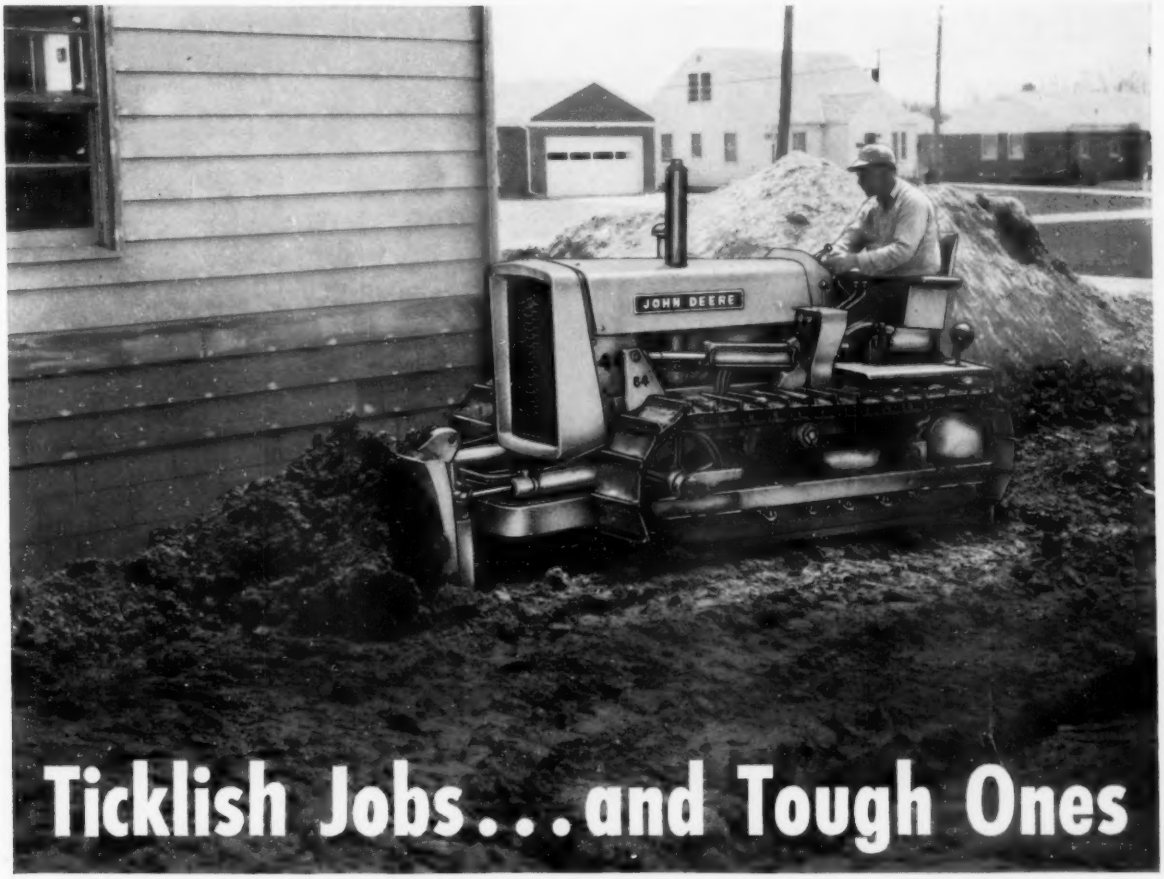
opening to the detriment of the slab. It also enables the joint capacity to be greatly increased, by distributing shrinkage and temperature cracking through the length of the slab, thus improving the riding qualities. Reinforcement should be placed in the top of the slab with a minimum cover of 1½ ins. depending on the slab thickness. Fabric reinforcement is normally specified and a rectangular mesh should be used with the main wires running in the longitudinal direction. Side laps are not required, but a central longitudinal joint should be provided with ½-in. diameter tie bars 4-ft. long and 3-ft. centers. The usual procedure for laying the concrete is to spread it to a depth which, after compaction will be 1½ to 2 ins. below the finished surface, lay the reinforcement on top, and then spread the remaining concrete to the correct surcharge, finally compacting the whole depth of the slab in one operation.

"Reinforcement of Concrete Roads." By D. E. A. Skinner, AMICE, AMIStructE. *Municipal Engineering*, February 27, 1959.

Forming of Concrete Structures

Sixty thousand bridge structures, varying in length from 20 ft. to more than a mile, will be constructed on the Federal-Aid Highway Program. It is also estimated that approximately 24,000 drainage structures, such as box culverts, will be needed. One type of equipment fast becoming popular for shoring on highway construction is sectional steel scaffolding. The following are seven advantages claimed for frame-type steel shoring: Free-standing sections; ease of erection; quickly adjustable; easy stripping; built-in scaffold; lighter timbers; and engineered layouts. Prefabricated steel forms are most useful in the construction of culverts, bridge piers, and abutments, retaining walls, columns, tunnels and similar structures. Advantages claimed for this type of forms are as follows: Reduction in labor and insurance costs; steel forms take up less storage and fabrication space; savings on contractor's overhead expense; reduction in over-all time required for the job because forms may be removed, transported and re-erected with ease; they have long life; accurate dimension control and high quality of surface finish produced; and great flexibility of arrangements possible with standard units and combinations thereof. Ganged forming has been used most successfully by volume contractors, contractors who can amortize the



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Pick either power plant—gasoline or Diesel—and you'll be assured of an outfit ideal for your requirements in site clearing, terracing, excavating, and cleanup work.

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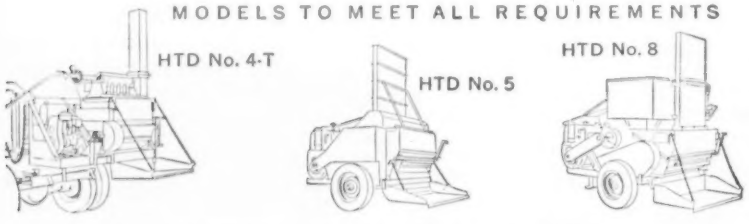

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3314 Cherry Lane, Fort Wayne, Indiana

admittedly higher initial unit cost of prefab forms and cranes, the two basic tools which must be used. Ganged forming is not intended for the small operator, although even the small operator could profitably investigate ganged forming before discarding it.

"A Potpourri of Money-Saving Ideas on Forming of Concrete Structures." *Modern Highways*, March, 1959.

Small Cars or the "Big Three"

From all over the United States come reports of small cars on trial in fleets that have never before used any vehicle other than a Chevrolet, Ford or Plymouth. The imported and American made compact cars are easy to drive, park and house; their initial cost is lower; and operating cost is generally less. The fleet operator cannot base his selection on these three points; when depreciation and individual preference come into the picture, the seemingly obvious advantages of small cars over large cars require a second look. The available fleet cars are: 1) The "Big Three"—Chevrolet, Ford and Plymouth; 2) the compact American - made cars — Rambler and Lark; and 3) imported vehicles. There are two general types of passenger car fleet operations: 1) Continually dispersed fleets such as those of intercity and interstate sales forces; and 2) local fleets that require daily dispatching and nightly storage such as those of muncipalities and utility companies. Across the country, small complements of compact cars are now undergoing trial. If they pass the demanding tests there might well be brewing a revolution in the business of fleet purchasing.

"Small Cars or the 'Big Three' for Fleet Use." By William F. Hallstead. PUBLIC WORKS, April, 1959.

Revolving Street Fund Helps Finance Program

Citizens of Ferguson, Mo., approved a proposal to issue bonds totaling $200,000 to finance a revolving fund to pay for public improvements. The five-year program was to cover 23 miles of streets. The city issues special assessments against property abutting the newly paved street and the special tax bills carry an annual interest rate of 8 percent. The high interest rate encourages property owners to pay assessments immediately and helps keep the fund revolving. Contractors bid jobs lower when assured of payment in cash. Bid prices were $3.40 psy for 6-in. concrete pavement and 7-in.

Architect and Engineer: J. N. Pease & Company, Charlotte, N.C.

For permanence and beauty in its newest waterworks building...

Charlotte, N.C., chose panels of precast concrete

The Charlotte Water Department planned for the future of their rapidly growing community when they designed their new $4,000,000 Hoskins Filter Plant.

They wanted permanent architectural beauty along with practical economy. They got it by using decorative precast concrete panels attached directly to the building's concrete frame. The exposed aggregate of the panels gives a lively and pleasing combination of texture and color. In addition, the use of precast panels saved construction time. And the building will keep its fresh beauty for a lifetime.

Architects and engineers everywhere will tell you: Versatile concrete is the one building material that offers unlimited new design possibilities for structures of all kinds. Write for free literature on precast panels. (U.S. and Canada only.)

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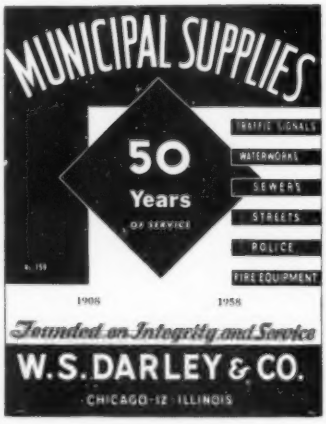

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pavement went for $3.65 psy. Street department crews grade the streets for paving and also handle backfilling and backsloping work, including driveways. Equipment consists of a tractor-shovel, motor grader and several trucks. The city also bears the cost of the engineering and administrative work.

"Revolving Street Fund Helps Suburb Finance Five-Year Program." By Robert C. Storey, City Manager, Ferguson, Mo. *Street Engineering*, March, 1959.

How to Upgrade Old Streets

To keep the 81.2 miles of streets in East Orange, N. J., in good condition, programs ranging from simple patch work to complete reconstruction are followed. Major repair and reconstruction work is contracted and the street division handles patching, seal coating and some resurfacing and realignment of the curb stones. Since 1957, 14 streets have been reconstructed at a cost of approximately $325,000. Some of the basic unit bid prices were as follows: Furnish and set granite curb in concrete, using 1 cu. ft. of concrete per lineal ft. of curb, straight section, $5.65 per ft. and radii $6.25 per ft.; and cost for paving the gutter area using macadam was $4.80 psy and using FABC was $5.30 psy. Three different types of oil are used in seal coating. On one project asphalt cement (85-100 penetration) was applied on a penetration macadam street at the rate of 1/3 gal. psy and covered with 3/8-in. washed stone chips at the rate of 23 lbs. psy. This method cost 14¢ psy. An MC-5 was applied to a sheet asphalt surfacing at the rate of ¼ gal. psy followed by an application of ⅜-in. washed stone at the rate of 24 lbs. psy. This cost was 12¢ psy. An RC-5 was used on an extremely hard sheet asphalt surface at an application rate of 1/4 gal. psy with 3/8-in. washed stone at 28 lbs. psy. This type of seal coating costs 15¢ psy. Concerning utility cuts, a permit must be obtained and the charge to the utility is for the actual cost of repairing the street cut plus 15 percent. This is around $12 psy.

"How to Upgrade Old Streets." By Arthur T. Brokaw, City Engineer, East Orange, N J. *The American City*, March, 1959.

Other Articles

"Greater Street Capacity with **Flexible Traffic Signals.**" Studies show that normal annual increases in traffic are creating a greater need than ever for increased capacity on local street sys-

How optically flat reflective sheeting keeps entire sign visible in any weather

With the ever-growing volume of traffic on city streets, it is increasingly important that signs function at their highest level at all times. This is especially true at night and in bad weather when the need for visibility is greatest.

Nighttime visibility of traffic signs through reflectivity has been an accepted fact for quite some time. But weather remains an enemy of most traffic signs . . . even reflective ones. That conditions of rain, snow, fog and the like curtail visibility is no secret. The "fair weather" sign, even under such conditions as a heavy dew, loses as much as 95% of its reflective quality.

Optically flat "Scotchlite" Reflective Sheeting, however, stands out in any weather. This is the sign material whose reflective elements are completely protected by a durable coating that not only guards the sign surface, but minimizes the distortion effects of weather.

No blackout in water

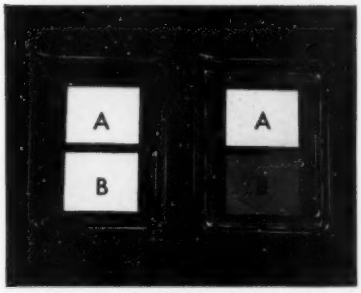

Fig. 1. The pan on the left holds two reflective samples. "A" is optically flat "Scotchlite" Sheeting; "B" is an exposed lens material. When dry, both reflect. In the pan on the right, one inch of water covers both samples. While "Scotchlite" Sheeting loses little of its designed reflectivity, sample "B," with its optical characteristics changed, "blacks out."

"Scotchlite" Reflective Sheeting, as you may know, is a reflex-reflector. It directs collected light from an approaching auto headlight right back to its source. An entire sign of this material reflects the full message of that sign—the true shape, color and legend. Because of the optically flat surface of the sign, its designed reflective characteristics are retained with a minimum loss of efficiency and performance in a heavy rainfall. Motorists can still see the entire sign clearly.

Where reflective elements are exposed, however, water fills in and alters the optical focus, causing a severe loss in reflection. The photo in Fig. 1 demonstrates this point.

Shown are two pieces of reflective material. That labelled "A" is optically flat "Scotchlite" Sheeting. "B" is exposed lens sign material. In the first picture, both are dry, both reflective. In the second, both have been placed *under water*. You can see how the sample of "Scotchlite" Sheeting continues to reflect to a high degree while the other, sample "B," has blacked out. Here is positive proof that "Scotchlite" Sheeting succeeds in communicating when exposed lens systems fail.

* * *

All-weather performance

Because of its high brightness and optically flat construction, a sign of "Scotchlite" Reflective Sheeting gives the best possible performance in rain, snow, dew, etc. It is the best answer man has yet devised against the enemy—weather.

Most effective sign material

Performance in any weather, of course, is just one measurement of an effective traffic sign. There are others that you may be interested in even more. For instance, angular performance for full-range brightness, ease of fabrication and maintenance, durability under city traffic conditions, economy. The most effective sign material for you is the material that offers the best performance and durability characteristics at the lowest over-all dollar cost. Only precision-made "Scotchlite" Reflective Sheeting meets these requirements so well.

Your 3M Representative will be happy to demonstrate any or all of these points to you. See him soon.

On city streets, motorists see the full shape, color and legend of a sign of "Scotchlite" Sheeting. Optically flat surface, with reflective elements protected from weather, remains distortion-free even during heavy rain. Sign won't "black out." Long and short range brightness stays high.

Or for more information on effective, durable all-weather signs of "Scotchlite" Sheeting, write: 3M Company, Dept. QV-59, St. Paul 6, Minnesota.

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tems. By Richard A. Overmyer, Deputy Commissioner, Dept. of Streets, Philadelphia, Pa. The American City, March, 1959.

"**Personnel Safety** on the Ohio Turnpike." Not a single worker has been killed or seriously injured in the performance of maintenance duties on the 241-mile Ohio Turnpike. By Benjamin H. Bowman, Traffic and Safety Engineer, Ohio Turnpike Commission. Public Works, April, 1959.

"**Assessment Paving Project** Matches Growing Population." A $2.25 million street reconstruction program has been completed in Odessa, Tex. By Jay W. Sharp, Assistant to the City Engineer, Odessa, Texas. Public Works, April, 1959.

"**Effect of Freeways** on Operation of San Francisco's Street System." Freeways have increased the speed of getting people home after work in this city, despite growing traffic load. By Ross T. Shoaf, City Traffic Engineer, San Francisco, Calif. Street Engineering, March, 1959.

"The Use of **Calcium Chloride for Soils Base Stabilization.**" By J. Eldridge Wood, Chief, Bureau of Soils and Materials, Maryland State Roads Commission. Constructioneer, March 9, 1959.

"How Photocopier Cut Location and Design Costs." **Deed copying work** done in days instead of months, and data and instruction processing speeded. Roads and Streets, March, 1959.

"Surveying With Electrons." West Virginia highways are being surveyed with **electronic Tellurometers** which measure distances and a three-passenger Bell helicopter is used to ferry crewmen from point to point. Highway Magazine, March, 1959.

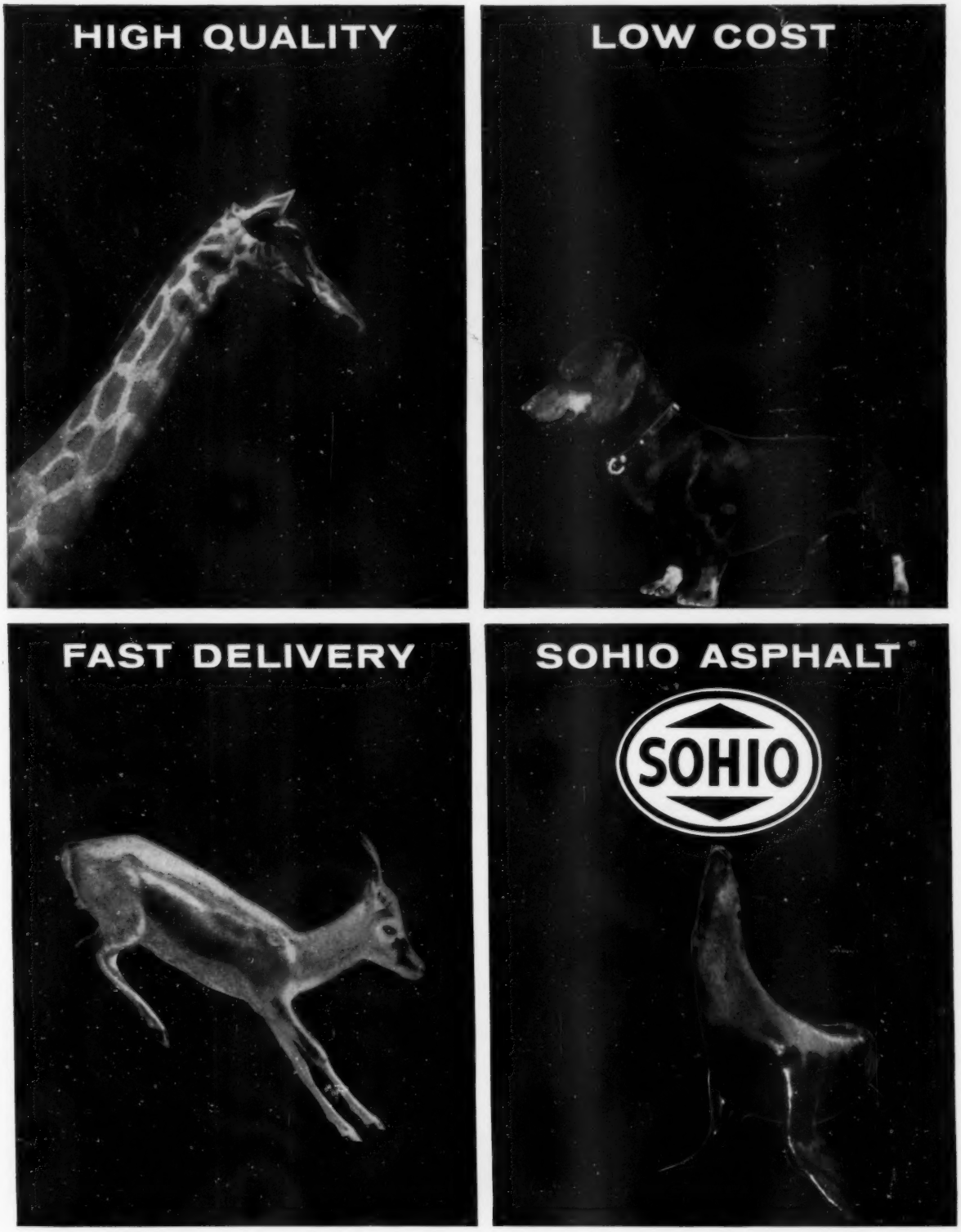
"Role of Pesticides in Ohio's Roadside-Development Program." **Use of chemicals in maintenance program** helps to do the job more easily and more economically if program has been well planned and if applications are done by well-trained personnel. By Wilbur J. Garmhausen, Chief Landscape Architect, Ohio Dept. of Highways. Better Roads, March, 1959.

• • •

Weathering is Most Serious Rust-Producing Condition

Salt water, humidity, fumes, chemicals—they're all named in a recent Rust-Oleum survey of 4,000 Chief Engineers—but weather is still the prime factor in rust-producing conditions deemed most serious.

Conducted by the Technical Services Department of the Rust-Oleum Corporation, manufacturers of rust preventive coatings, the survey reveals that 33 percent of the Chief Engineers consider weathering to constitute the most serious rust-producing condition; 14 percent named chemicals; 13 percent stated that humidity was the chief factor; and 10 percent named fumes. Other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conditions in order of importance were steam 9 percent; heat 7 percent; salt water 6 percent; smoke 5 percent; and brine 4 percent.

In another question it was learned that test applications are favored by most industrial users. For example, 27 percent indicated that they make test applications most of the time; 37 percent stated that they made test applications some of the time; while 36 percent said that they did not utilize test applications of coatings.

Insofar as maintenance crews for the application of protective coatings was concerned, 38 percent stated that they used their own maintenance crew; 12 percent said that they employed a painting contracting firm; and 50 percent stated that they used both their own maintenance crew as well as a painting contractor.

Price appeared to be a secondary factor in reasons why coatings are specified for metal protection. For example, 52 percent indicated that the rust-inhibitive qualities of the product were most important in selection of the coating; 38 percent named long wear as most important; 5 percent said that cooperation by the coating salesman was a requisite; 2 percent indicated price; and 3 percent named color and coverage.

Detailed information on this survey may be obtained by writing the Rust-Oleum Corp., 2799 Oakton St., Evanston, Ill.

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NEWS OF ENGINEERS

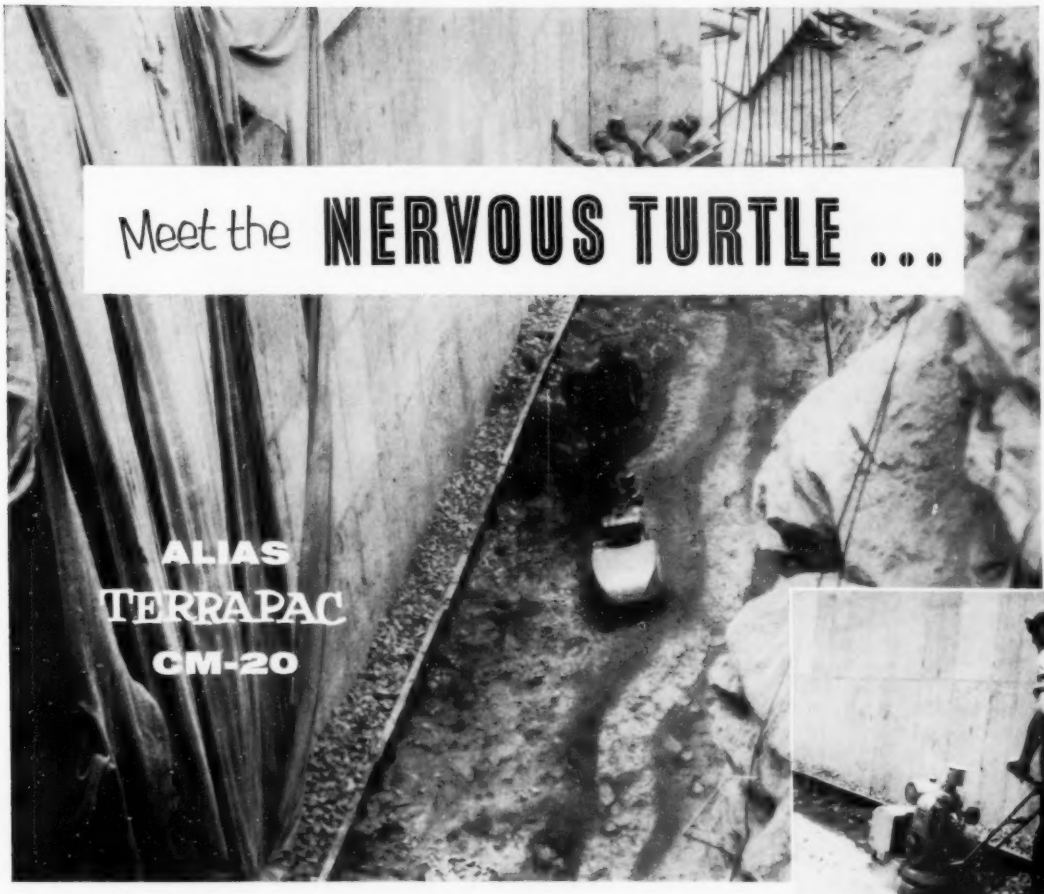
DR. JAMES C. LAMB III has been appointed Associate Professor of Sanitary Engineering at the School of Public Health, University of North Carolina, Chapel Hill. Dr. Lamb will be in charge of research work on color removal from pulp mill wastes which is being sponsored by The Mead Corp.

EUGENE V. AVERY has been promoted to Assistant Chief Engineer of the St. Paul, Minn., Department of Public Works; he has been Chief Traffic Engineer since 1953. Arthur W. Tews is Chief Engineer and Adrian P. Winkel Commissioner of Public Works.

CHARLES H. LEE and MICHAEL PRASZKER have formed the firm of Lee and Praszker, consulting engineers, with offices at 58 Sutter St., San Francisco, Calif., which has been Mr. Lee's office since 1921. The firm will specialize in soil mechanics foundation engineering and applied hydrology.

JAMES A. LANG, formerly of Lang & Cummings, Inc., consulting engineers of Minneapolis, Minn., has become chief of the Electrical Engineering Section of Magney, Setter, Leach, Lindstrom and Erickson, Inc., architects and engineers also of Minneapolis.

VICTOR M. EHLERS, Director of the Sanitary Engineering Division of the Texas State Department of Health, died in Austin, Texas, on March 20. He was the first sanitary engineer to be employed by Texas, being hired temporarily in 1915 to clean up stream pollution but remaining to become state sanitary engineer. His services have been nationally recognized. He was president of the FSIWA and of many other groups, and vice-president of APHA. His death removes one of the wisest and most capable men ever to serve as state sanitary engineer; he provided organization and personal leadership matched by few others. Your editor recalls how it was always a comfort to have "one of Vic's boys" in a place where the going was tough during the war.



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Down South they wouldn't know what a CM-20 is, but ask about the Nervous Turtle and you get an earful . . . It's the only heavy-duty, one-man operated compactor on the market - develops a 6,600 lb. compaction wallop at speeds up to 75 feet a minute . . . Handles not only granular materials but many clay mixtures as well . . . Maneuvers close to abutments, retaining walls and piling; ideal for backfill jobs and shoulder work, railroad embankments, floors and foundations . . . The CM-20 penetrates up to 30 inches or more - in one or two passes, while its smaller version, the CM-15, will compact lifts up to 12 inches . . . Ask your local Terrapac distributor to demonstrate the model that is best suited to meet all of your varied job requirements. Call him today - you'll be ahead. 41-78

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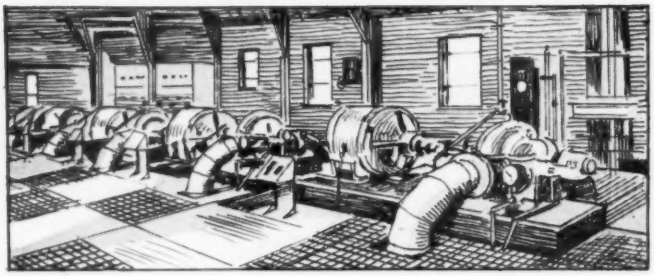

Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Illinois State Water Survey

The Illinois Section of the American Water Works Association commemorates its 50th anniversary in March of this year. The author salutes the Illinois Section by reviewing the activities of the Illinois State Water Survey during these past fifty years and the outstanding personalities who have guided these activities. As a fact-collecting and research organization the Illinois State Water Survey is a unique government agency, owing to its wide scope of interests, to an extremely flexible research policy, and to close ties with a large state university. Its record of research in water, in water supply, and in sewage and industrial waste treatment demonstrates the many ways this agency has responded to changing water problems. It has been an important training ground for leaders in water supply and water research as noted in the list of important "alumni" who have found their places in water resources activities of industries, universities and government agencies throughout the country.

"The Illinois State Water Survey". By T. E. Larson, and S. M. Bartell. *Water and Sewage Works*, March, 1959.

Centrifugal Pumps

Centrifugal pumps are those in which fluid is given an initial velocity and pressure by a rotating impeller. They consist essentially of: 1) A rotary impeller which draws in the fluid at its center, and 2) a stationary casing in which the fluid is thrown from the ends of the impeller and is guided into the discharge outlet. The pump may have any number of impellers. The shape of the impeller and the casing and the number of impellers or stages determine the efficiency of the pump. Some of the advantages of the centrifugal pump as compared to the plunger type are: 1) Low first cost; 2) compactness; 3) absence of valves and pistons; 4) low rate of depreciation; 5) uniform pressure and flow of liquid; 6) simplicity of design and ease of operation; 7) freedom from shock injury through water hammer; 8) high rotating speed permitting direct connection to electric motors and steam turbines; 9) ability to handle dirty water; 10) pressures unable to increase beyond predetermined working values; and 11) ease of repair. Some disadvantages are: 1) Efficiency not as high as the best types of plunger pumps; 2) cannot be driven by slow speed engines, when high lifts are desired; and 3) the rate of flow cannot be regulated readily for wide ranges in duty. The author discusses pump characteristics, efficiencies, installation and pipe layout, operation and maintenance in order to obtain the most effective use of centrifugal pumps.

"Centrifugal Pumps." By Paul C. Ziemke. *Water and Sewage Works*, March, 1959.

Land Uses and Water Requirements

Information valuable in the design of water works can be gained from an understanding of the effect that land uses have on water demands. The extent of future expansion for each land use, the intensity of development and the direction and limits of growth influence water use. So do recent trends in domestic water consumption. From the knowledge of how much water each individual use requires, the total amount consumed in each area can be computed. Knowledge of peak water demands are the bases for designing certain distribution facilities, but for proper design it is necessary to know where maximum users are located and how much each user is likely to use. Per capita water consumption for all classifications of customers has increased from about 90 gallons per day in 1900 to about 155 gallons in 1955 according to various surveys. Three factors dominate in affecting the steady increase in that portion attributed to residential consumption: (1) Modern technological advances in water-using home appliances; (2) higher incomes and better standards of living; and (3) the trend toward suburban living. The automatic washing machine, the lawn sprinkler system, and air conditioning are representative of the devices which consume considerable quantities of water. The average water consumption has increased considerably but the peak demands have increased at a much higher rate, and seasonal variations have also been more marked than formerly realized. In certain communities the peak hourly rates have been found to exceed the combined effect of fire flow plus maximum daily consumption and these have become the determinant factor in the design of the distribution system. Commercial consumption which includes all water used in stores, office buildings, restaurants, hotels, garages and other business establishments must also be considered in determining total water consumption. Other factors affecting water consumption are geographical location; water pressure; water cost; metering; climate, including rainfall and its spacing, which affects lawn sprinkling; the size of the community; family income; residential densities; property values; and business activity. The land development plan is an analytical study of the future changes that will take place in the

A sure sign of spring for 50 years...

IOWA *hydrant on the job—neat, attractive, efficient. Easily serviced by one man.*

IOWA *valves and hydrants ready for installation—a familiar scene in hundreds of communities.*

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• This spring—as every spring for the last 50 years—more and more IOWA valves and hydrants are being put in place to serve the needs of hundreds of growing communities.

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That's why IOWA products are a good buy—this year and every year. And IOWA's high standing in the waterworks field, backed by ample resources, assures parts and replacements will always be available for economical future maintenance. This long-time future service is part of what you buy at IOWA. That's why IOWA is a good company to do business with...this year...or any year.

Let us send you details on Iowa's complete line of valves and hydrants

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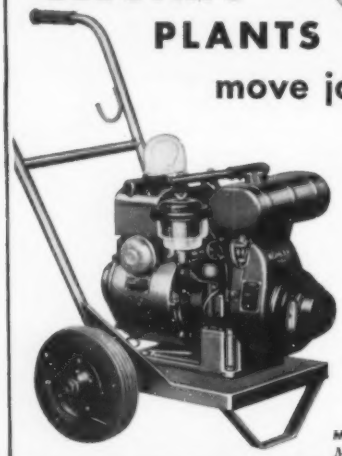

Lightweight Kohler plants quickly pay back their cost—and more—in work time saved. Easy to truck or move where needed for power tools, floodlights, on street and park maintenance jobs . . . Emergency plants for police communications, treatment and filtration plants, when normal power fails. Sizes to 100 KW, gasoline and diesel. Write for folder E-6.

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. . . for high pressure leakage thru concrete in deep basements, tunnels, shafts and foundations. Mortar will set in 15-30 seconds - forms plug that bonds tightly. Will not wash away.

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city based on the existing conditions and significant trends in the urban area.

"Land Uses and Water Consumption Requirements." By Rodolfo Silva. PUBLIC WORKS, April, 1959.

Public Relations For a Utility

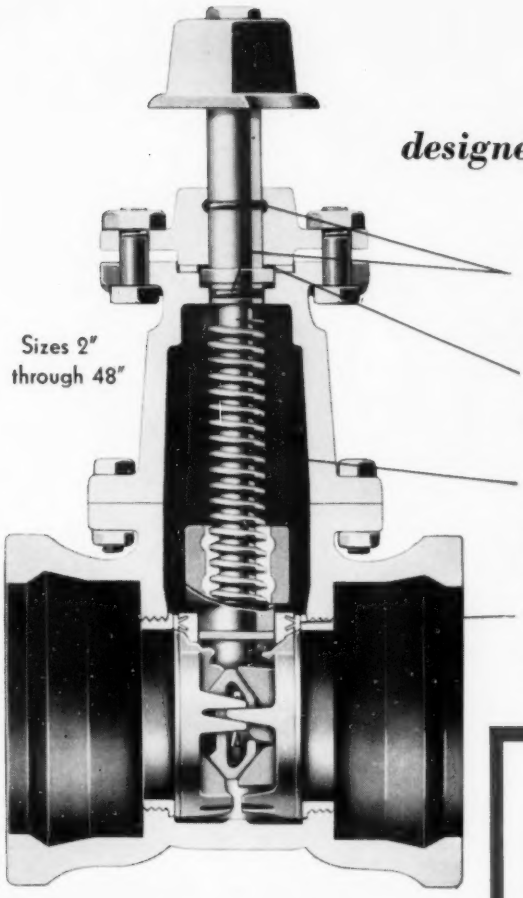
Good public relations are not easily obtained. It takes determination, thought, and a lot of work on the part of a lot of people to achieve success. The discussion of good public relations in this article is basically a recitation of the thinking and program in this field of the East Bay Municipal Utility District, Oakland, Calif. This program is based on several major foundations: 1) A corporate personality; 2) employee public relations; 3) communication with the public and; 4) special techniques. The author agrees with Philip F. Walsh when he stated that good service is essential to good public relations, but wishes to add that management can profit greatly by a full exploration of the entire problem of making a good service really pay off. He has discussed in detail the EBMUD public relations program and has cited many examples.

"Public Relations for a Modern Utility." By John W. McFarland. *Jour. A.W.W.A.*, March, 1959.

Ground Water Recharge

Ground water recharge which generally occurs by the infiltration and downward percolation of precipitation or stream flow through the zone of aeration to the water table has been studied by the United States Geological Survey at Seabrook, N. J. This article describes studies of water movement in the zone of aeration by means of tensiometer readings. The zone of aeration, according to Meinzer, has three principal divisions. The lowest belt, the capillary fringe, is "the belt immediately above the water table that contains water drawn up from the zone of saturation by capillary action." The intermediate belt "lies between the belt of soil water and the capillary fringe." The top belt, the belt of soil water, "consists of soil and other materials that lie near enough to the surface to discharge water into the atmosphere in perceptible quantities by the action of plants or by soil evaporation and convection." The authors have observed that applied water does not distribute itself uniformly throughout the length of a soil column unless it is in sufficient quantity to

designed for minimum maintenance!



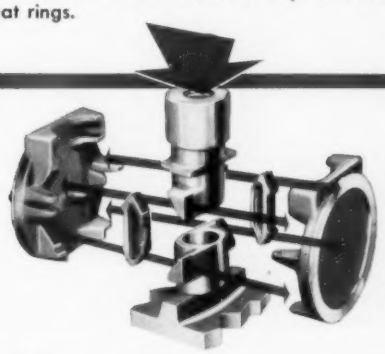
Sizes 2" through 48"

"O" Ring Stem Seals . . . "O" ring at bottom provides a positive water-tight seal. Upper "O" ring seals dirt and water from bearing surfaces and acts as a reserve pressure seal.

Lubricant Reservoir . . . the area between the "O" rings is filled with a special, lifetime lubricant. Each time the valve is operated, both "O" rings and thrust collar are completely lubricated.

Heavy Bronze Stems . . . are machined from high tensile strength solid bronze rod for all valves up to 16". Electrically upset thrust collar improves grain structure. Valves 18" and larger have stems cast from extremely high tensile strength manganese bronze.

Bronze Disc Rings . . . are dovetailed to become part of the disc and are then machined for precise mating with the seat rings.



Four Point Wedging Mechansim . . . exerts even pressure at four points near the outer edge of each disc to eliminate disc deflection and distortion and to assure tight shut-offs.

Exclusive Disc Movement . . . discs move in an inverted "T" manner, as shown, when valve is opened or closed. The entire disc and wedging mechanism is held together as a unit by special bronze pins passing through interlocking lugs that are cast integrally with each disc. This permits operation of valve in any postition. These pins and lugs also control the amount of disc movement. By maintaining a minimum of clearance, discs positively shear incrustations and deposits from seat ring upon closing.

Opposed Wedges . . . on top nut eliminate binding or twisting of stem. Nut is free to rotate and the only forces on the stem are straight up or straight down.

MUELLER® gate valves

You can forget about the gate valves in your water supply and fire protection systems when they're Mueller Iron Body, Bronze Mounted Gate Valves. All of these valves are Double Disc, Parallel Seat type specifically designed for water distribution piping. Long-life features, dependability features, and ease of operation features assure you of years of maintenance-free service. These features are typical of the great attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry. Write for complete information.

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Municipal Water Filter Installation cost can be cut 1/3 to 2/3 with...

★ This Filter is also used extensively for swimming pool and industrial plant water filtration.

SPARKLER *Diatomite* **FILTERS**

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL RJ because:—

1. The original cost of a diatomite plant for public supply is ⅓ to ⅔ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces bacteria and removes organic matter to an exceptionally high degree with attendant low chlorination requirement. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.
5. Sparkler Filters can be used with pretreated water when such treatment is necessary or desirable.

Sparkler filtration engineers have introduced, in the RJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced developments in recent years.

Less than 0.2% of the harvested filtered water is required to sluice and clean the Model RJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

Operators can be easily trained to handle this filter, highly skilled specialized personnel is not required to insure efficient performance.

Sparkler Model RJ filters can supply practically any required volume of city water. Single units with a capacity of 2,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.

SPARKLER FILTERS

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Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

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bring the entire soil column to field capacity level. In other words, the applied water moistens a certain depth to field capacity and then the water movement ceases. Additional water must be applied to obtain further penetration as a liquid.

"Zone of Aeration and Its Relationship to Ground Water Recharge." By Irwin Remson, James R. Randolph, and Henry C. Barksdale. *Jour. A.W.W.A.*, March, 1959.

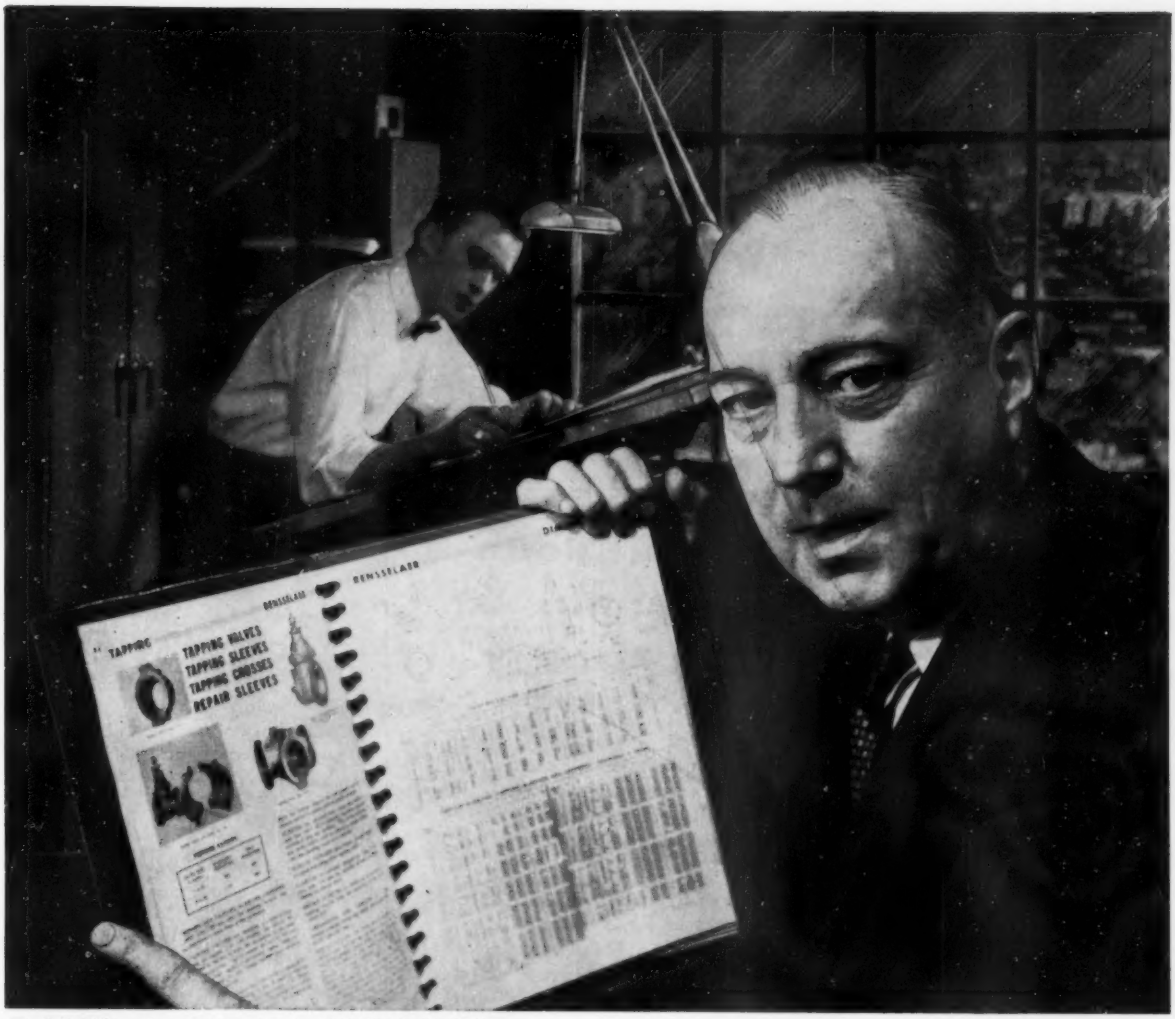
Chicago's Future Water Works

Thanks to a farsighted five-year $154,600,000 capital improvement program the City of Chicago plans to have by 1962 sufficient capacity to meet the water needs of 1980. Improvements will include the construction of four tunnels, the world's largest filtration plant, expansion of the South Side filtration plant, modernization of 10 of the 11 existing pumping stations, erection of a twelfth, and the laying of 130 miles of water mains. The completion of this program will bring filtered water to 3,000,000 residents of the North Side and 31 suburbs who do not now enjoy this service. More than 1,500,000 residents of the South Side and 27 suburbs have been receiving filtered water since 1947. The 960-mgd Central District Filtration plant will be completed in 1961 in a 60-acre cofferdam located just north of Navy Pier. The experience gained from the South District Filtration plant, which indicated the feasibility of operating at such high filter rates as 3.5 to even 5.0 gallons per square foot per minute, will enable this new plant to operate at about 1,700 mgd—740 mgd in excess of its rated capacity. Expansion of the South District Filtration plant to a capacity in excess of 800 mgd will provide a total filtration capacity of 2,500 mgd in 1960—enough to meet the needs of Chicago in 1980.

"Chicago's Water Works of Tomorrow." By James W. Jardine. The *American City*, March, 1959.

Springfield's Water Supply

Prior to the improvements completed last year, Springfield, Ohio's, water problems were difficult indeed. But in 1955 consulting engineers recommended an extensive improvement program consisting of a series of ten wells in the Mad River section, with a combined capacity of 40 mgd and the construction of a 36-mgd softening plant. The ten wells of 30-inch diameter were spaced 300 feet apart and sunk



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Many engineers and waterworks superintendents ask themselves this question before specifying a particular gate valve:

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FOR EASE AND DEPENDABILITY use Ludlow and Rensselaer tapping sleeves and valves for branchline connections to main lines under pressure.

WRITE FOR THE L&R GATE VALVE CATALOG, showing the most complete selection of outstanding design features available today. There are sizes from 2" to 72", plus custom designing for special applications.

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to a depth of about 100 feet and were provided with well screens about 55 feet long beginning about 45 feet below the surface. The raw water is pumped to the lime and soda ash softening plant through a pair of transmission lines approximately 4500 feet long. Water enters the plant by passing through a Parshall flume and a hydraulic jump which provides quick mixing of the two chemicals with the raw water. The chemically-laden water is then given the opportunity to flocculate and settle in two stages. The piping arrangement permits recirculation of the sludge from these settling basins back to the mixing flumes, thereby reducing the amount of chemical needed for softening and flocculation. The plant is also designed to provide a simple and thrifty method of recarbonating and stabilizing the highly alkaline water that results from lime and soda ash softening. The operators need merely to draw return sludge from the secondary clarifier and also to add raw water that has a high natural carbon dioxide content, and bicarbonates, thus correcting the alkalinity. Calgon applied at a rate of 0.5 ppm ahead of the filters, acts as a secondary protection against adverse effects on the filters or the distribution system. The filters operating at a rate of 3 gallons per minute discharge the water into a 5,000,000 gallon reservoir. To finance the improvements, a new rate schedule was adopted which is more than double the old rates.

"A Series of Wells Along the River." *The American City*, March, 1959.

Laboratory Controls

To meet the public's demand for a clear and sparkling, bacteriologically safe, tasteless, odorless and soft water, it is necessary to provide adequate laboratory control. Only by proper monitoring of the treatment processes can a plant produce a high quality product with the greatest possible efficiency. The type and function of controls vary with the source of supply. The main problems for which control is needed in surface supplies include turbidity, color, taste and odor, bacterial contamination and hardness. These characteristics vary considerably in a river or stream supply and to a lesser extent in impounded water supplies. In impounded supplies it may be necessary to treat for color removal during the hot summer months through adjustment of pH of the raw water to around 6.0 by the addition of alum. Lime or soda ash is then added to the treated water for the prevention of red water problems in the distribution system. Laboratory control is necessary for proper control. Similarly, jar tests are performed to determine the optimum coagulant dosage. The author has discussed the function of several laboratory control procedures. He also suggests that small water supplies may obtain qualified assistance in the performance of laboratory control by soliciting the assistance of the local high school science teacher and perhaps senior science students. For approximately $1,000 a small water plant could be equipped satisfactorily to perform the routine control tests required.

"To Get 'Near-Perfect' Water: Use Tight Laboratory Control." By E. L. Smith. *Water Works Engineering*, March, 1959.

Other Articles

"'Dumbo' Analyzes Custer's System." Electronic digital computer compares effectiveness of various **distribution network changes** in days—not weeks. By S. A. Michael. Water Works Engineering, March, 1959.

"A Booster Station That 'Floats' On a

Dicalite Filtration ...answers all 5 questions on municipal water supply

CLARITY... No longer any question on this point. The records of municipal filter stations operating with Dicalite Filteraids prove that, day after day, turbidity in filtered water is easily held to 0.5 ppm or below.

CAPITAL INVESTMENT... From 20% to 35% lower for a diatomite filter system than for a rapid sand system of equal capacity. This is based both on expert engineering estimates and on comparisons of actual costs where all other factors were equal.

OPERATING COST... For all practical purposes, diatomite and rapid sand show equal operating costs on the basis of time, labor, operating supplies and power.

SPACE REQUIREMENTS... For each square foot required for a diatomite system, you will need *at least 4 square feet* for a rapid sand system. The tremendous advantage of diatomite filtration on this point is obvious.

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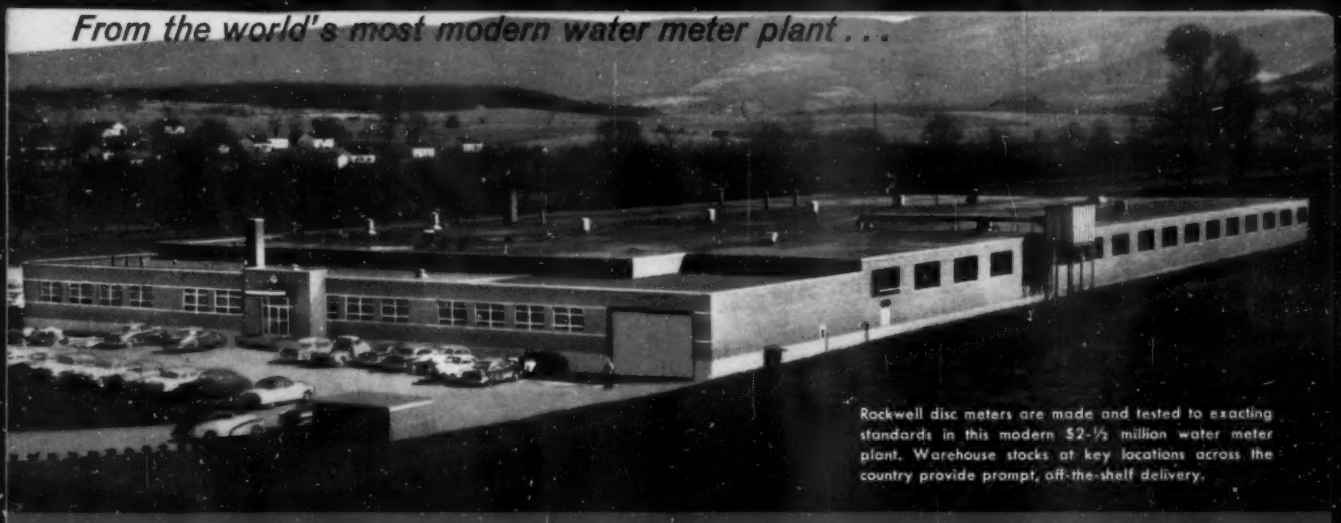

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THE BEST DISC METERS YOU CAN BUY

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Rockwell disc meters are made with costly *stainless steel trim* to assure corrosion resistance and durability. Their construction includes a patented *"O"-ring stuffing box assembly* which stops leaks, binds, troubles and expense. Another extra value is the *large red center test hand* on all registers which provides a closer check on accuracy and a convenient means for determining leaks on customer's premises. And even parts for Rockwell disc meters are neatly packaged in convenient quantities to stack on shelves—eliminate the need for bulky bins—simplify inventory control and reordering. All this adds up to better disc meter values and service for you. Write today for latest bulletins. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

DISC TYPE WATER METERS

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County-Wide Water System." **Automatic controls** program two water pumps and select variable speeds to **meet changing hydraulic conditions** of the Onondaga County Water Authority, near Syracuse, N. Y. By Earl F. O'Brien. Water Works Engineering, March, 1959.

"Water Works Management." Part I. Three of the nine papers presented at the 62nd annual meeting of the Penna. Water Works Ass'n. appear in this issue. The papers are presented by Abel Wolman, F. C. Amsbary and Fred Merryfield, Water and Sewage Works, March, 1959.

"Portable Stilling Well for Measurement of Weir Discharges." The article describes a stilling well which is portable, non-obstructing, easily assembled, and requires no special training for installation and operation. By T. P. Quirk. Public Works, April, 1959.

"Cleaning Existing Water Mains Eliminates Need for New Ones." **By cleaning approximately 52,000 ft. of 4 to 10-in. water mains,** Carmi, Illinois, has been able to accomplish this feat. By Clyde Smith. Public Works, April, 1959.

"Determination of Calcium, Magnesium, and Total Hardness by Automatic Spectrophotometric Titration." This automatic procedure is well suited for the **determination of calcium and magnesium** in both hard and soft waters. By H. V. Malmstadt and T. P. Hadjiioannou. Jour. A.W.W.A., March, 1959.

"Use of Microstrainer at Denver." Microstraining is a form of **filtration** which has been installed at the Denver water plant to remove algae and suspended matter present in **Marston Lake** water. By G. G. Turre with discussion by G. R. Evans. Jour. A.W.W.A., March, 1959.

• • •

Changing Patterns in PESTICIDES

BEFORE THE war, the arsenicals, some of the fluorides, nicotine products, phosphorus and pyrethrum or rotenone were the most frequently used materials in insect control. For rodent control, white arsenic, barium carbonate, thallium sulfate, zinc phosphide, phosphorus, cyanides, carbon disulfide, methyl bromide, strychnine and red squill were used. In control of fungi, sulfur, formaldehyde, some copper salts and a few mercurials were used. For weeds, arsenites, carbon disulfide, sodium chlorate, salt and a few others were reasonably effective.

In 1939, many laboratories in the United States anticipated a changing pattern in pesticides, because in several areas of pest control the most useful chemicals came from abroad. For example red squill, strychnine, and thallium were all or largely imported. In 1941, because of growing military demands, this pattern was crystallized rapidly and a tremendous increase in the search for new synthetic chemicals was stimulated. Within a few years, alphanaphthylthiourea (Antu), sodium fluoroacetate (1080), and warfarin became the leading rodent and control chemicals.

In insect control, this started the "DDT" age. The discovery of the effectiveness of this insecticide set the chemical laboratories to work, and the list of chlorinated hydrocarbons made available for testing as possible pesticides soon included benzene hexachloride, toxaphene, heptachlor, chlordane, lindane, aldrin, dieldrin, strobane, methoxychlor and endrin. As the research in this field progressed and the potential dangers of the new chemicals were examined, a trend was established to consider the safety of the candidate materials as an essential part of their evaluation.

Further interest in the safety factor was stimulated by the discovery of the pesticidal value of the class of chemicals called "organic phosphates." Parathion was the first pesticide in this category to gain ac-

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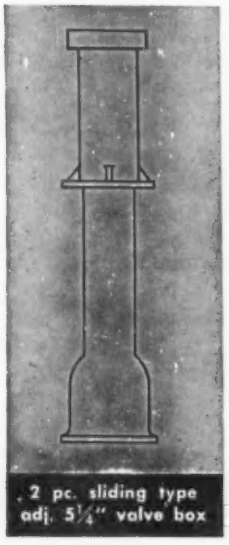
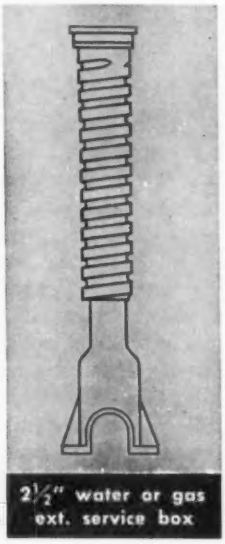
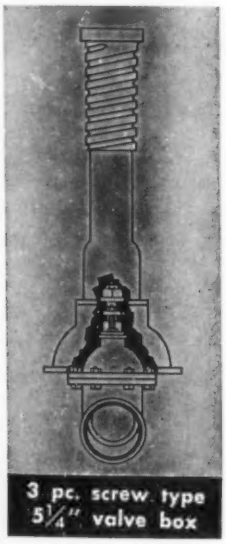
No matter what size, shape or style municipal casting you may desire — you're practically sure to find a "Buffalo" casting to serve your needs. Or, where desired, castings may be made to your own specifications. Whether you need valve, service or roadway boxes, meter boxes, manhole rings and covers or other municipal castings, you'll find all "Buffalo" castings designed for service and dependability.



2 pc. sliding type adj. 5¼" valve box



2½" water or gas ext. service box



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cepted use in this country. As with DDT, however, parathion soon had a host of competitive products among which were tetraethyl pyrophosphate (TEPP), systox, malathion, Phosdrin, and thimet.

As these two new classes of chemicals reached widespread use, medical men expressed increasing concern over the possible effects the chemicals might have on humans who were exposed repeatedly to them whether by ingestion, inhalation or skin absorption. Questions were raised for which complete answers were lacking, and an entirely new pattern was started. This pattern was based on the principle that the user of a pesticide should know its potential hazards and how to protect himself, other humans and valuable animals against injury, and the public should be protected against dangerous residues in and on foods.

Operating under the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act which became law in 1947, the U. S. Department of Agriculture requires on the labels of all pesticides offered for interstate shipment precise instruction which will be adequate to protect the user when they are followed. Acting under the procedures outlined in the Pesticide Chemicals Amendment to the Federal Food, Drug, and Cosmetic Act, the Food and Drug Administration establishes the levels of residues of pesticides which will be safe when consumed by humans or, in many cases, by animals; and sets tolerances on the various raw agricultural commodities on which the chemicals are proposed for use.

This added control has divided the concept of safety into two main parts: Operator protection against acute skin absorption and inhalation, and public protection against long-continued or "chronic" ingestion; and it has started a number of trends in the search for new pesticides depending upon the end uses of the material. The company producing the chemical and the research agencies testing it must undertake work to determine the following attributes: 1) Effectiveness against at least one pest of economic importance; 2) precautions needed to insure safe handling; 3) toxicity from acute and chronic exposures; and 4) persistence of residues and safe tolerances.

Under this new concept a product may be less effective, but if it is safer to handle or leaves a less persistent residue, it will deserve the added scrutiny it will get.

Added developments in recent months may forecast still another pattern. The use of radioactivity to destroy the ability of certain insects to reproduce has disclosed a new pest control procedure suitable for trial with species having specific life habits making this system feasible. The distribution of certain specific bacterial cultures in dusts over crops infested with susceptible insects and the use of predatory or parasitic insects to destroy unwanted species are procedures being given further careful study. These methods will tend to replace chemical controls, if successful, and thereby may reduce residue problems.

With the authority in the laws now on the books governing pesticides and with the growing knowledge of toxicity and tolerances, feelings of fear should change to respect. As this occurs, pesticides can be used more effectively and with greater safety.

This information is from an article by J. C. Ward, entitled, "Changing Patterns in Pesticides," *Archives of Industrial Health*, August, 1958, and abstracted in the *U. S. Navy Medical News Letter*, November 21, 1958.

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rugged is the word for this new 90-M!

Put this new "80" Series pump on the job anywhere . . . this is what you've got! *Amazing performance*, proved time after time. *Higher suction lifts*, and *peak efficiency*, resulting from Gorman-Rupp's patented design. *Fast starts, surer starts* —with high speed repriming. *Dependability*, backed by Gorman-Rupp. Isn't it time you tried one of the new "80" Series Pumps? They're available now.

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Completely new from the ground up—backed by 10 years of rotary field experience—this all new Ingersoll-Rand Gyro-Flo 125 portable rotary compressor is based on results of extensive research, performance evaluation and customer suggestions.

Smaller and more compact than the original Gyro-Flo 125, this new unit incorporates many of the proven Gyro-Flo design features plus a host of new features that make it the best 125-cfm portable compressor available.

Some of its features are: larger engines at slower speed (1800-rpm)...60" track for greater stability on rough terrain...full-length tool boxes with more storage capacity...side covers that fold back safely away from operating eye-level...fuel and air tanks under lockable cover to guard against tampering...automatic drainage of oil from cylinders when unit is shut down...and provision for inspection of all rotor vanes. The new Gyro-Flo 125 is powered by 1800-rpm Continental engines—either gasoline or diesel. Ask your Ingersoll-Rand representative for complete details or send today for a copy of Form 2930.

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2-WHEEL MOUNTING	GASOLINE	DIESEL
Weight (dry)	2442	2503
Weight (wet)	2647	2737
Length, incl. draw bar	10'1"	10'1"
Width	5'8¾"	5'8¾"
Height	5'1½"	5'1½"
Track	60"	60"
LESS RUNNING GEAR (INCL. SHIPPING SKID)		
Weight (dry)	2165	2226
Weight (wet)	2370	2450
Length	5'9¾"	5'9¾"
Width	2'8¼"	2'8¼"
Height	3'8¾"	3'9½"

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AN UNBEATABLE COMBINATION...GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS

USE OF HIGHWAY EMBANKMENTS FOR THE EMPOUNDMENT OF WATER

G. M. WILLIAMS,

Assistant Commissioner for Engineering, Bureau of Public Roads, Washington, D. C.

This article is based on a paper at the 57th Annual American Road Builders Association at Dallas, Texas.

PROJECTS wherein the programs for wildlife conservation and for highway development have been coordinated, with mutually beneficial results, have been reported. In such cases, the separate responsibilities and limits of authority of the conservation and highway interests must be reviewed, and the engineering problems associated with a dual purpose conservation-highway project be segregated into two classes:

a) Those of analysis of the physical conditions that exist for any proposed conservation project, coupled with an evaluation of the estimated costs for the lands, the water rights and the engineering works with respect to the benefits that would be expected to accrue to the general public should the project be developed. In brief, this is justification that the proposed project will accomplish the broad conservation policies declared to be in the public interest by legislation of the states and the Federal Government. The responsibility for such analysis and justification rests with the conservation interests.

b) Those of technical design of the highway facility itself, for its location, profile and waterway or drainage control structures, either as a single purpose highway project, or as a dual purpose highway-conservation project. The responsibility for the design of the highway facility and any appurtenance that affects its integrity rests with the highway interests.

In actual practice, those problems of the first class must be resolved first if they are to be resolved at all, for it is only where a conservation program will be beneficial that the highway designs will need to include special features to accommodate it.

Federal laws pertaining to conservation are the Watershed Protection and Flood Prevention Act, as amended in 1956, administered by the Soil Conservation Service; the Wildlife Restoration Act, approved in 1937; and the Fish Restoration and Management Act of 1950, both of which authorize the Secretary of the Interior to cooperate with the states; and the Migratory Bird Hunting Stamp Act of 1934, also administered by the Secretary of the Interior.

Under these laws, the Departments of Agriculture and of the Interior, and through them the various state and local agencies, have the responsibility of evaluating plans for conservation of water, lands, fish and wildlife and to determine that individual projects are justified.

The Bureau of Public Roads of the Department of Commerce is responsible for the administration of the federal-aid program and for certain direct federal highway programs undertaken in cooperation with other federal agencies as well as with the state highway departments. The Federal-Aid Road Act provided that the United States shall aid the states in the construction of rural post roads, but federal funds may be used only for highway purposes in accordance with definitions contained in the legislation. Most state highway departments operate under state legislation which similarly limits departmental expenditures. While all highway agencies and departments do give attention to the preservation of natural resources, they are not charged with responsibilities under law for conservation programs nor do they have authority, except possibly in some special instances, to expend highway funds for "works of improvement" that are for conservation interests.

Accordingly, it is necessary that an agency responsible for a conservation program also be responsible for determining the justification for an individual conservation project that might be undertaken jointly.

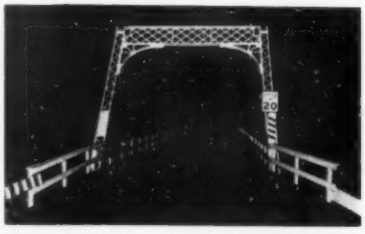
This means that the costs for work separate from the highway, plus that for additional work, if any, in the highway project itself, must be justifiable as conservation costs and that funds to cover such work must be provided by the conservation interests.

Acceleration in the rate of improving the public highways of the nation has caught the attention of those responsible for conservation programs. They are aware that under the present financing arrangements for highways, many highway projects will be accomplished years in advance of the date that was considered possible prior to 1956. They are also aware that there will need to be a step-up in the rate of their evaluation of "works of improvement" if such conservation items are to be accomplished jointly or concurrently with related highway improvements.

The federal agencies administering conservation programs and the Bureau of Public Roads are furnishing local departments with information on the conservation programs in order to provide for a proper understanding of responsibilities, and to arrange for liaison which will foster coordinated and harmonious operations. As examples, a memorandum was issued by the Bureau of Public Roads in 1958, on the "Utilization of Highway Embankments for Impoundment of Water," and a memorandum was issued by the Bureau of Sport Fisheries and Wildlife, also in 1958, on the "Bureau of Public Roads Federal-aid Highway Program."

Many engineering problems will have to be studied by the conservation groups before individual projects can be justified. The groups have knowledge of areas where "works of improvement may be justifiably established." However, except in those States where advance scheduling of highway improvements is practiced and such schedules are public information, the conservation groups have difficulty in determining where to concentrate their effort to obtain maximum results.

Better Visibility at Night



● **BRIDGE coated with "Codit" reflective liquid is sharply outlined both day and night. "Codit" is a product of Minnesota Mining & Manufacturing Co.**

The conservation groups will need to know the approximate alinement, profile and drainage facilities planned for a highway improvement. Working from that base the conservation group can evaluate the desirable extent of or the most appropriate adjustments to be made in the lands and/or waters of the area; the extent of rights-of-way or other property interests to be acquired; water rights and control-of-flow works to be constructed separately from any highway works; necessary or desirable changes in the location and the design of the highway facility if the conservation work is to be accomplished; provision of access roads to the conservation area; overall operation and maintenance of the conservation facility; and consideration of differences, if any, in the costs of operation and maintenance of associated highway facilities. It is expected that the highway agencies will cooperate fully with the conservation groups in studies of changes in the location and design.

When it is established that a conservation "work of improvement" is justifiable and that it is acceptable to a highway agency, final design plans will be prepared accordingly. In general, the additional engineering problems to be considered by the highway department will be: Stability of an embankment if such is to serve as a dam with fluctuating reservoir water level; extent of protective facing on reservoir side of the fill; need for an impermeable core and a permeable downstream embankment, possibly with a protective blanket; capacity of drainage facilities to handle the peak discharge provision of properly designed spillways, probably with stilling basins; evaluation of the effect of the spillway design on the backwater level in the reservoir; provision of fish ladders; and provision of a way of access to the conservation area and to the lower levels of the embankment.

None of the anticipated engineering problems is particularly difficult or unusual, but it can be expected that in some cases the additional costs to provide a satisfactory engineering design for the highway facility may be quite large. There is probably greater opportunity for problems of human relationships to arise than for tough engineering problems. However, there are no reasons why a satisfactory program cannot be developed resulting in benefits to all.

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This cast-iron plug screws into brass insert . . . cannot be twisted or broken off.
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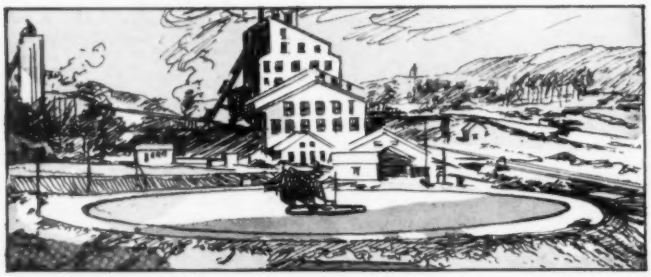


Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

Wasting Radioactivity

The continually increasing production and use of radioactive isotopes has caused many problems in their disposal. High-level liquid wastes have been stored in tanks, at the site of production. To date this has amounted to 100 million gallons, and the ultimate disposal of this waste is a major problem. Where conditions permit, medium-level wastes are discharged into the ground, using the soil as a holding agent having ion exchange capacity. In populous areas they are concentrated by evaporation and stored as a high level waste for ultimate disposal at sea or by burial. A number of the radioisotope users or producers concentrate medium-level waste to a sludge in order that it may be handled as a solid. Concentration methods may include evaporation, chemical precipitation, or ion exchange. Low-level wastes are discharged directly to streams, using dilution techniques and continuous monitoring.

Solid wastes at major AEC sites are buried, with five installations operating permanently controlled burial grounds. Gases, fumes, and dusts are filtered or scrubbed and discharged through stacks to the atmosphere, subject to continuous monitoring. Sea disposal is practiced on the East and West Coasts and involves packaging the waste in weighted containers and sinking the containers at a depth of at least 1,000 fathoms. Precast concrete vaults and 55-gal. drums are the packages most commonly used. The research and development in this field work is being done on fixing waste materials into a stable solid medium to eliminate the possibility of migration from the environment. Efforts are also being made to study the effect on animal and plant life of the disposal of reactor cooling water and other low-level waste into streams and soils.

"Radioactive Wastes Disposals." By Albert L. Smith. *Industrial Wastes*, March-April, 1959.

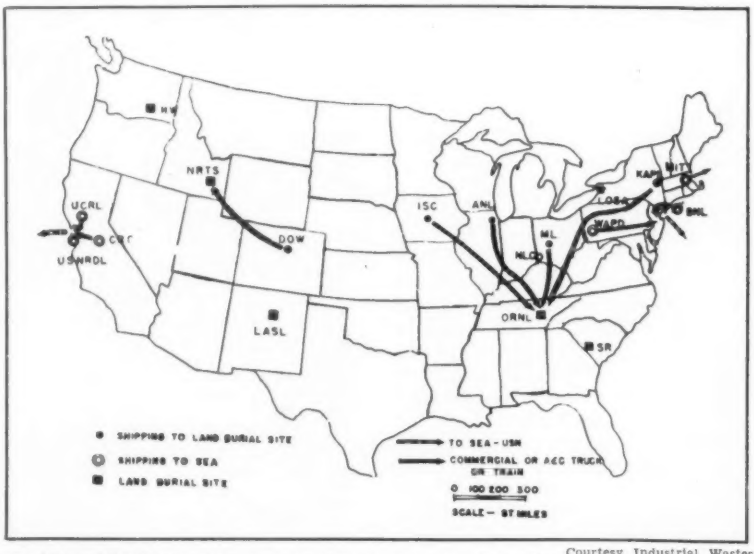
Reclaiming Sulphite Liquor

In an effort to resolve the problem of low cost temporary street paving in new housing areas the City of Milwaukee started in 1956 to experiment with the use of sulphite liquor from pulp and paper mills as a road binding material. The City specified that the sulphite liquor should contain at least 10 percent solids by weight and that a cylinder made up of the liquor and sandy soil should have double the compressive strength of a similar cylinder where the binding material is water. The method of application varied, and sometimes involved diluting a 52 percent concentrate to 25 percent or using it directly as 10 or 12 percent. It is applied by gravity feed to a previously compacted base from a tank truck equipped with splash boards. The treatment was repeated as required from time to time. In the three years of use, over 12 million gallons of 10 percent liquor has been applied to more than 300 miles of streets. In 1956, 2.3 applications of the 10 percent concentration were used per street. In 1957, there were 4.15 applications and 5.72 in 1957. The contract unit price for 10 percent liquor was $0.0146 per gallon in 1957 and $0.0141 per gallon in 1958. No corrosion or odor problems have been encountered. The streets may be opened for traffic immediately after treatment.

"Sulphite Liquor as a Road Binder Material." By R. A. Burmeister. PUBLIC WORKS, April, 1959.

Pest Control Chemical Waste

Rapid expansion of the pest control industry in Great Britain in recent years has enhanced the prob-



Courtesy Industrial Wastes

● **MAP SHOWS locations of installations storing high level radioactive wastes.**

ANNOUNCING...

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Available Through Specification of Consulting Engineers . . . for Use With Gas Recirculation Equipment Supplied and Engineered By Approved and Experienced Manufacturers of Sludge Digestion Equipment.

INFORMATION IS AVAILABLE to Consulting Engineers from Chicago Pump Company or its Distributors . . . pertaining to the application of this system and license fees for its use in existing or new digesters designed for present or future maximum digester loadings.

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43

operating and specified installations of CRP* since 1953 prove its unparalleled acceptance . . . and these advantages:

Savings

1. A 2/3 reduction in new tank volume requirements.
2. Simplified plant operation due to sludge homogeneity.

Performance

1. Produces required biological reduction of solids in 1/3 to 1/7 tank capacity.
2. Normal quantity of gas produced at higher rates.
3. Complete absence of digester scum.

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lem of disposal of wastes from the manufacture of chemicals at the Fisons, England, plant of Pest Control, Ltd. Chemicals manufactured included weed killers (dinitro-orthocresol and substituted phenoxy-acetic acid and trichloracetic acid), chlorinated hydrocarbon and phosphorus insecticides, and fungicides containing copper and mercury. About 34,000 gpd of waste is produced, high in dissolved solids, phenols, cresols and BOD. The treatment plant finally evolved utilized three major steps: adsorption of organic chemicals with activated carbon, removal of toxic metals, and biological treatment to remove oxygen demand. The adsorption was accomplished at a controlled pH of 7 to 7.5 in 25-ft. high towers containing granular activated carbon designed for a flow rate of 3,000 gph. The spent carbon is reclaimed periodically by reactivation in a rotary kiln. The heavy metals in the effluent from the carbon treatment are removed by precipitation with lime. This preliminary treatment permits biological oxidation using trickling filters operated on the alternating double filtration principle. Domestic sewage from the plant and river water are used as diluents preceding the filtration step. The filter effluent is aerated and discharged to the River Cam.

"Fisons Pest Control Trade Effluent Plant." By A. E. Lambden. *The Surveyor*, February 28, 1959.

Eliminating Food Processing Odors

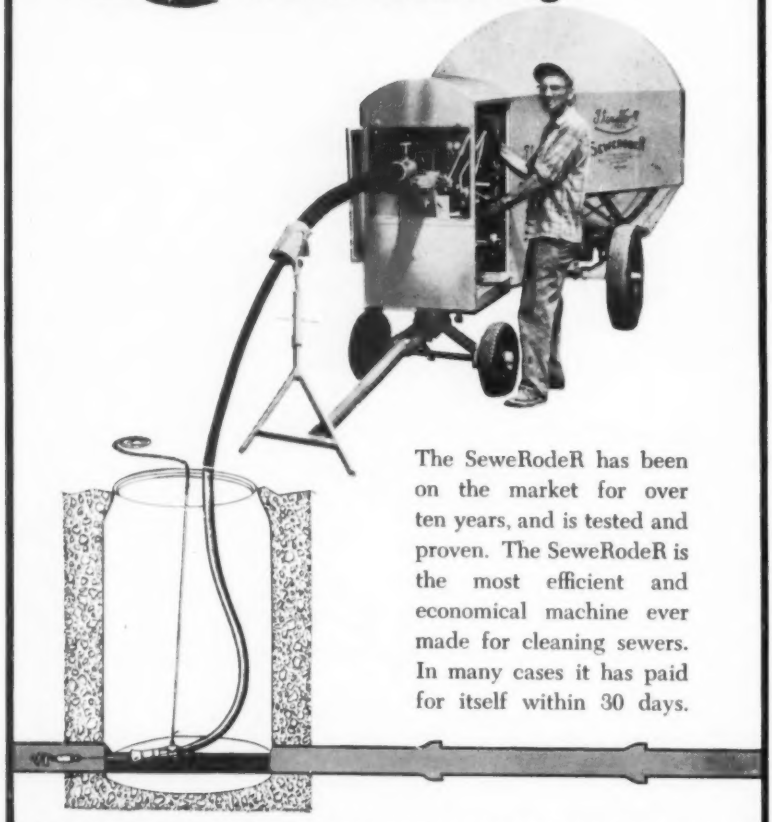
In order to solve the problem of eliminating odors resulting from the manufacture of chicken liver paste, catalytic combustion was tried, culminating efforts with several methods. The offensive odors occurred from the slow roasting of onions in chicken fat. The fumes are ducted to a combustion chamber equipped with a catalyst battery of 200 brick size units, each composed of slender rods coated with a film of platinum and aluminum alloy. The vapors enter the combustion chamber at 150°F, are preheated to 650°F before contact with the catalyst. The catalytic units are made by Oxy-Catalyst, Inc. About 3000 cfm are being treated successfully with fuel costs amounting to less than $4 per day.

"Pollution Solution for Food Processors." By Frank L. Kay. *Industrial Wastes*, March-April, 1959.

Petroleum Wastes and Petrochemical Manufacture

Petrochemical manufacturing provides a means for profitable upgrading materials obtained incident to oil and gas production and previously regarded as wastes. Over 60 percent of the new rubber, 95 percent of the resins and plastics and many synthetic fibers are derived from petrochemicals. Four basic methods are used for separating individual compounds from the hydrocarbon complexes in petroleum to obtain pure feedstocks for petrochemical production. These are distillation for separation at different boiling points, extraction with selective solvents having reference for specific hydrocarbons, adsorption or absorption with materials showing selective preference, and crystallization by adjustment of process temperatures and pressures. Cracking, dehydrogenation, oxidation, absorption, distillation, and extraction are among the most widely used petrochemical production and purification methods. The manufacture of butadiene from normal butane involves dehydrogenation or removal of hydrogen atoms from hydrocarbon molecules. Making ethylene involves cracking, or the breaking of the bond between carbon atoms to produce molecules of other hydrocarbons. Ammonia

The SeweRodeR is preferred for all sewer cleaning!



The SeweRodeR has been on the market for over ten years, and is tested and proven. The SeweRodeR is the most efficient and economical machine ever made for cleaning sewers. In many cases it has paid for itself within 30 days.

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manufacture uses reactions characteristic of oxidation, dehydrogenation, absorption and fractional distillation. Process efficiency and pollution abatement are related as are the respective measures taken to improve these steps. Such measures are recycling unreacted materials, regenerating and reusing absorbents, avoiding contact between process gases and water, reusing cooling water, and eliminating product losses.

"Basic Petrochemical Processes as Waste Sources." By W. L. Ruggles. *Sewage and Industrial Wastes,* March, 1959.

Other Articles

"Water Resources and Industrial Management." By W. H. Schuette. Both industry and the control agencies are becoming aware of their respective roles in pollution abatement, producing a trend toward definite progress. Sewage and Industrial Wastes, March, 1959.

"Rapid Tax Amortization for Industrial Waste Treatment Facilities." By James J. Flannery. While rapid tax amortization may be an inducement to investment under certain conditions, it is difficult to measure the extent of inducement, especially in regard to waste treatment facilities. Sewage and Industrial Wastes, March, 1959.

"Tank Car Wash Water." By G. Gutzeit. Complex wastes require elaborate treatment and control measures at the Masury, Ohio, manufacturing and maintenance plant of General American Transportation Corporation. Industrial Wastes, March-April, 1959.

Maryland-Delaware Water & Sewage Association

The Thirty-Second Annual Meeting of this Association will be held June 3 to 5 at the Commander Hotel in Ocean City, Maryland. An informal get-together will be held on Wednesday evening, June 3, technical sessions will meet all day Thursday and Friday morning and the annual dinner will be Thursday evening. W. McLean Bingley is Secretary-Treasurer.

New Status for Water Pollution Control Program

The water pollution control activities of the Public Health Service have been given division status and Gordon E. McCallum who has been in charge of the work is now Chief of the Division. Formerly Water Supply and Pollution Control was a branch of the Division of Sanitary Engineering Services. Another change in the sanitary engineering program of the Service is the creation of the position of Associate Chief of Sanitary Engineering Services.

NEW MB CONTAIN-O-PACK®

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— The new self-loading M-B Contain-O-Pack beats all other methods of handling multiple point waste collection. Here's proof: The powerful 3000 lb. capacity side loader with *extendible* boom can *reach* containers on loading docks, over curbing, between cars, over fences . . . faster and easier than *any* other system. The loading boom folds neatly out of the way, allowing hand loading through the side door at any time. — Trucks with any cab style—standard chassis—can be used. Does not require fish-plating or other expensive truck modifications. — M-B offers three standard sizes of containers —1½, 2 and 3 cu. yd.—in various unique styles. Special sizes and shapes are available. End dumping door on box opens automatically only when container is in position to empty . . . prevents scattering of refuse. — The time-proved M-B Packer Body packs anything, in bodies up to 38 cu. yd. in capacity . . . has positive "push-out" unloading . . . assures lowest cost per yard performance. — There's a lot more to the full, profitable story. Call your distributor or the M-B Corporation, New Holstein, Wis.

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LINE MARKERS PACKER BODIES SWEEPERS

Wrought Iron Pipe Used in Sewage Treatment Plant

THE LARGEST sanitation project ever undertaken for construction at one time in the United States is the new $80,000,000 intercepting sewer system and sewage treatment plant nearing completion in and around Pittsburgh.

Being constructed at McKees Rocks, Pa., on the banks of the Ohio River by the Allegheny County Sanitary Authority, the new plant will handle wastes for 70 communities, including Pittsburgh.

The picture at left was taken in the chlorine room and shows a workman giving the last few turns to 1-inch diameter extra heavy 4-D wrought iron pipe.

Several hundred tons of corrosion resistant 4-D wrought iron pipe, in sizes 1 to 36-inch O.D., were specified for this mammoth project. Services include: Liquid chlorine lines, effluent lines, chimney vents, tank car connectors, waste, vent and conduit lines, appurtenances in sludge concentration tanks, vertical down shafts and force main compressed air lines. The pipe was produced by A. M. Byers Company.

Financing and Planning Federal-Aid Highways in Metropolitan Areas

ALFRED BERARDUCCI,
Assistant City Engineer,
Highways and Expressways,
City of Detroit

This paper was presented at the 57th Annual Convention of the American Road Builders' Association at Dallas, Texas, and has been slightly condensed.

THE KEY to good highway programming in any state is a good working relationship between the state highway department, the county units and the cities. A major part of the economy of this nation now depends on highway transportation. Since this economy is of vital interest to all governmental units, there should be no competition in highway building between the three units of government.

In order to achieve a balanced highway system, all units of government should utilize their financial means to the utmost, in order that federal aid money can be used to the best advantage.

We believe we have made considerable progress toward that end in Michigan by revising our highway laws and modifying the distribution of highway revenues.

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These revisions in the laws and in the distribution of the highway revenues were arrived at after making a thorough highway needs study of the entire state.

Initiated in 1947, the study was made cooperatively by the State Highway Department, the counties, and the cities, in conjunction with the highway users groups. Once the needs were known, it was possible to develop a revenue distribution formula which would allocate portions of the highway revenues in the State to each of the units of government.

The legislature, in 1951, revised the highway laws in accordance with the joint recommendations of the interested agencies; in 1956, the needs study was up-dated and the highway law was again revised in 1957 in accordance with the recommendations of the study group.

The highway revenues in the State are derived from the gasoline tax and the license taxes on vehicles.

The current highway laws of Michigan require cities of over 30,000 population to participate with the State Highway Department in the cost of trunkline improvements and require the counties to participate with the State in the cost of secondary roads.

In order to use federal aid matching money, it is necessary that the counties and the cities provide their share of matching funds to accompany the state's share towards the federal aid contribution. By participating in the cost, the counties and cities have a direct interest in highway improvements, and request only those projects which are necessary and desirable.

The highway revisions enacted in 1951 and in 1957 provide for the distribution of the highway revenues as follows: 47 percent to the State Highway Department, 35 percent to the various counties in the state, and 18 percent to the various cities in the state. The distribution to the counties and to the cities is made by means of a formula which involves population, car registrations, and street and road mileages.

Distribution of Highway Funds

The distribution of a portion of the highway funds, directly to the cities and counties, has enabled these units of government to participate with the state in many needed improvements, and by their joint action to utilize efficiently the federal funds which are allocated to the state.

In our opinion, the intent of Congress when it passed the 1956 High-

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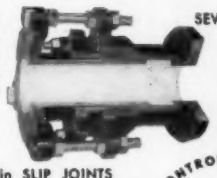

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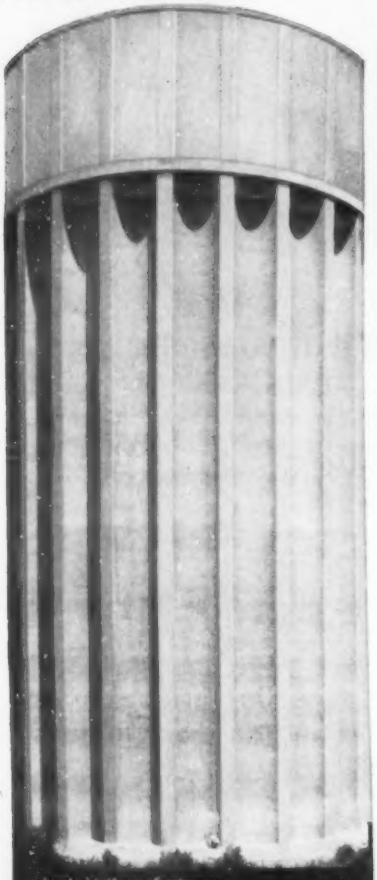

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way Law was not only that the Interstate Highway System would be completed according to a specific timetable, but that local governments, with some assistance from the federal government, would establish a similar timetable for the completion of the entire national highway and street network. It is recognized that local highways and streets have to be improved as feeder roads to the Interstate System if the network, as a whole, is to function efficiently. The Act clearly states that traffic congestion in our cities is intolerable, and that immediate steps must be taken by both Federal and State Highway Administrators to program highways on the basis of use or need. The Act provides that, after a certain date, funds shall be allocated on the basis of needs. Studies have shown that approximately half of the money should be spent in urban areas. For the first time, Congress recognized that the construction of the Interstate System was the prime responsibility of the Federal Government, and agreed to pay 90 percent of all construction costs, including right-of-way costs both inside and outside of cities.

It is the intent of Congress that this new Interstate System of 41,000 miles is to be built as a complete system. It is not expected that the states will build only the rural portions of such highways and end them at the city limits, because this would not be building a complete system.

Congress recognized the fact that for the first three years the formula agreed upon might not provide enough funds for some states to carry out the program. Therefore, provisions were made that, where necessary in order to meet the schedule, any state could proceed to furnish the necessary additional financing and be reimbursed from future federal funds for the federal share of these additional expenditures. In our opinion, Congress reflected the general desires of all highway users in the Bill as adopted. The additional funds that may be required can be advanced either by using available cash or by issuing long-term bonds, to be retired from future gas and weight tax revenues. In addition, a portion of the 10 percent local funds can be accumulated by joint participation between the states and cities, and in some cases by the participation of the appropriate counties. For that reason, the local units of government must be ready to approach the problem by providing substan-

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Convention Manager
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tial local funds to meet federal aid contributions.

In Detroit, we are building an expressway system which, because of its nature, is quite expensive, and which would be impossible for any one unit of government to undertake. However, by reason of the operation of the highway laws in Michigan, it is possible to complete these costly projects by using a part of the joint funds of the State Highway Department, Wayne County, the City of Detroit and the Federal Aid contributions that are available.

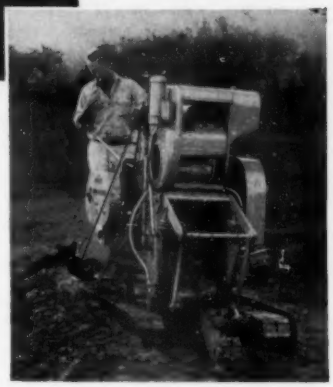
This has been accomplished by use of laws which permit bond financing of the projects, and which also permit the pledging of portions of the revenues from each of the units for retiring the bonds. The bond financing provisions of the current federal aid laws have also been an aid in accelerating this type of construction. Because of the success of this type of financing, this method of constructing costly projects is now being used by other cities and other counties in the state of Michigan.

In working out complicated plans for highway construction in the City of Detroit, we were fortunate in having complete cooperation between the three units of government involved in the Detroit area, in addition to that of the Bureau of Public Roads.

All matters affecting the design and the construction of expressways are handled cooperatively by a joint engineering staff consisting of engineers from the city, county, state and federal government. The Engineering Committee and its Subcommittees consists of planning engineers, traffic engineers, designers and construction engineers. By drawing on the combined knowledge of all groups involved in this type of work, a satisfactory program is developed.

We believe that all states can meet similar problems by bringing their highway house in order. The taxpayers have a right to expect close cooperation and teamwork from the highway builders in the same way that such cooperation is found in private industry. We believe that it is advisable that the people who pay the bill for these construction costs should be kept informed regarding the needs, the solution proposed and how the money is spent. Finally, we also believe that the consumers, who are the highway users; and the builders, who are the highway engineers, must work together to solve our highway problem.

Which Size For YOU?



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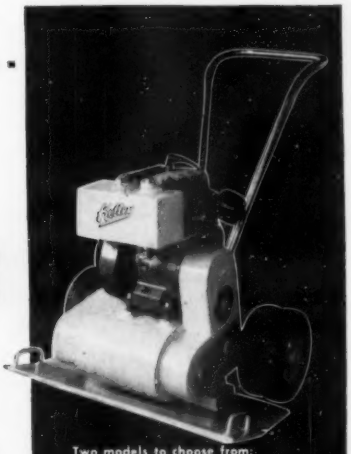

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Below, Model 18KT packing down sub-base materials on a road-widening job.

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● **PUBLIC WORKS activities of Weston Township, in central Wisconsin, are greatly assisted by this new International Travelette truck which features both a six-man cab and a six-foot pickup body. The four-wheel-drive vehicle carries all of the equipment needed for a roadside clearance project plus the full crew shown above.**

Operating Results from Small Aerobic Digestion Plants

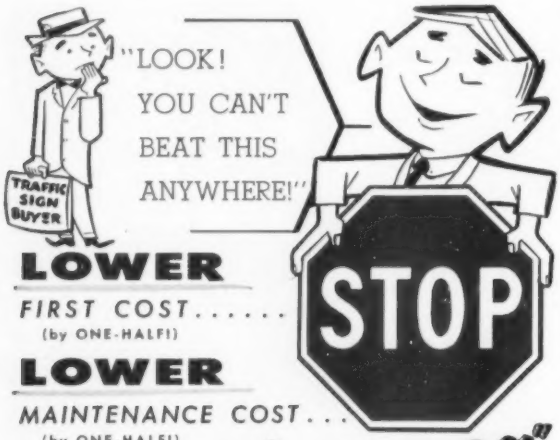
Interesting data on the operation of small aerobic digestion plants are contained in Bulletin 135-A, published by the Chicago Pump Co. One of the smallest plants, serving the Stuart Baker School in Birmingham, Mich., was designed to treat 7,500 gpd. In March, 1958, with a flow of 7,000 gpd, composite samples over a 7-hour period showed raw sewage BOD at 451 mg/L and final BOD at 13 mg/L. The Fetrow Truck Stop plant on Route 40, Ohio, was designed for 11,000 gpd; in Dec., 1956, with flow at 6,000 gpd, 6-hour composite samples showed raw BOD at 510 mg/L and final effluent at 2 mg/L.

The municipal plant at Mead, Nebr., designed to treat 30,000 gpd., had a flow of 14,000 gpd. in Oct., 1957, at which time 24-hour composite samples taken by the State Board of Health showed raw sewage BOD at 340 mg/L and effluent at 12.6 mg/L. Suspended solids were reduced from 620 to 30 mg/L. The Valley Springs, Calif., municipal plant, designed for 40,000 gpd., in Feb., 1958 was treating 26,000 gpd., and reducing BOD from 140 to 8 mg/L, based on grab sampling by the city. The Villa Anna Subdivision, Louisville, Ky., installed a plant with design capacity of 170,000 gpd. Tests by the Metropolitan Sewer District of Louisville, based on grab samples during the period Jan. to April, 1958, when flow was 90,000 gpd., showed raw sewage BOD at 310 mg/L and effluent at 28 mg/L. Suspended solids were reduced from 218 to 16 mg/L.

• • •

Well Qualified Engineer is Available

An engineer, 36 years old, with BE and BS degrees, desires to make a change. He has had experience in water works and in highway design and construction. His experience in waterworks includes well supplies, pipeline layouts, planning and financing, personnel, public relations and general supervision of operations. His work in the highway field involved surveys, utility relocation, right-of-ways and drainage. He is a registered professional engineer. Write Box JR, Public Works, 200 South Broad St., Ridgewood, N. J.



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STEEL BUILDINGS

USED IN PARK AND FORESTRY DEPARTMENTS

CARL F. MARTIN,
Parks and Recreation Superintendent
Wayne County
Detroit, Michigan

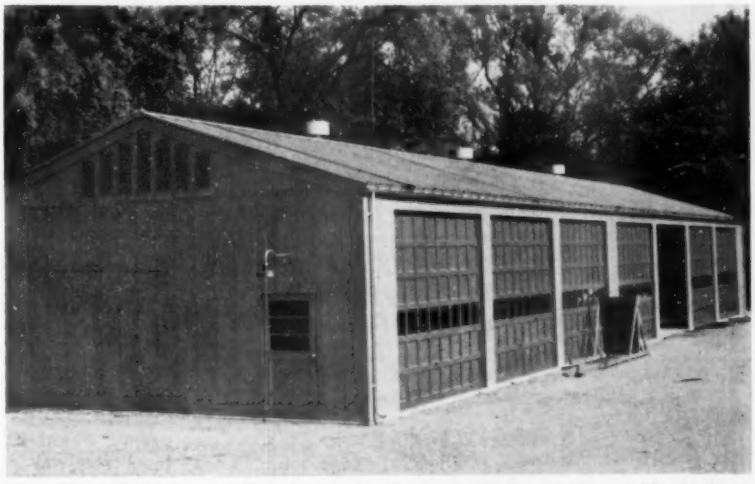
AT MERRIMAN Yard, the Parks and Forestry Division of the Wayne County Road Commission, Detroit, Mich., has built five Armco steel buildings, three in 1955 and two in 1957. With the exception of such installations as overhead doors, roof ventilators, electrical service and painting, the Park Construction Department erected the buildings, including footings and floors. The three buildings built in 1955 are described as follows:

One 12-ft. x 40-ft. x 200-ft. (with 10 sliding doors). The building cost $11,300; five roof ventilators and gutters were installed at a cost of $1100. This building has a gravel floor and is used for housing Forestry Dept. trucks, a bulldozer, a Cleveland trenching machine, spray hose, extension ladders, playground equipment, swing and slide frames and commercial fertilizer.

A 12-ft. x 20-ft. x 60-ft. building cost $1,520 and the gutters were installed at a cost of $170. This is a shed type building open on one side, with a gravel floor. The building shelters discs, spring-tooth drags, plows, manure spreader, tractor-pulled rollers and seed and fertilizer spreaders.

Another 12-ft. x 20-ft. x 60-ft. building cost $3,000; and four overhead doors were installed at a cost of $1,200; the gutters and three roof ventilators cost $590. This building has a 6-in. reinforced concrete floor, and it is used jointly by the Park Construction Dept. and the Forestry Dept. A 20-ft. x 20-ft. mouse-proof grass seed crib separates the two departments. The Forestry Dept. stores tree trimming ladders, shovels, rakes, picks, block and tackle, parts bins, hand weed sprayers, etc. in the building. The Park Construction Dept. stores copper and iron water pipe and fittings, mortar boxes, salamanders, scaffolding, oakum, water main parts, fence fittings and cement and mortar.

The buildings built in 1957 include a 12 ft. x 40 ft. x 100 ft. building which cost $6,530. Five overhead doors were installed at a cost of $1,400 and the gutters and five roof ventilators cost $585. This building has a 6-in. reinforced concrete floor and ten skylight roof panels. It provides storage for farm tractors, weed and tree spraying equipment and grass mowers for the Park Maintenance Department.



● **STEEL BUILDING** used by the Wayne County Road Commission at Northville is similar to those erected by the Parks and Forestry Division at the Merriman Yard.

● **INTERIOR** of one of the Road Commission's buildings. Unobstructed floor area and overhead doors along the length of the building facilitate equipment storage.

● **FORESTRY department trucks and other equipment are kept in this building, which is 200 feet long and 40 feet wide.**

● **ALL OF THE steel buildings are painted inside and out with aluminum paint. Roofs are coated with an asphalt compound.**

A 12-ft. x 20-ft. x 60-ft. building, also built in 1957, cost $3,890; the four overhead doors cost $1,120; and the gutters and roof vents cost $665.

This building also has a 6-in. reinforced concrete floor and eight skylight roof panels. One end of the building is used as a carpenter shop. The ceiling of this section is paneled with plywood and insulated. The center section is used for storage of better grade lumber, shingles, window screening and other building supplies. The third section is used by the Park Maintenance Dept. to store liquid soap, toilet tissue, window glass, plumbing fixtures, stoves, stove pipe, athletic equipment, etc. The carpenter shop is heated with a coal stove.

All five buildings are painted inside and out with aluminum paint. The roofs are coated with an asphalt compound.

George Washington Bridge Will Have a Lower Level

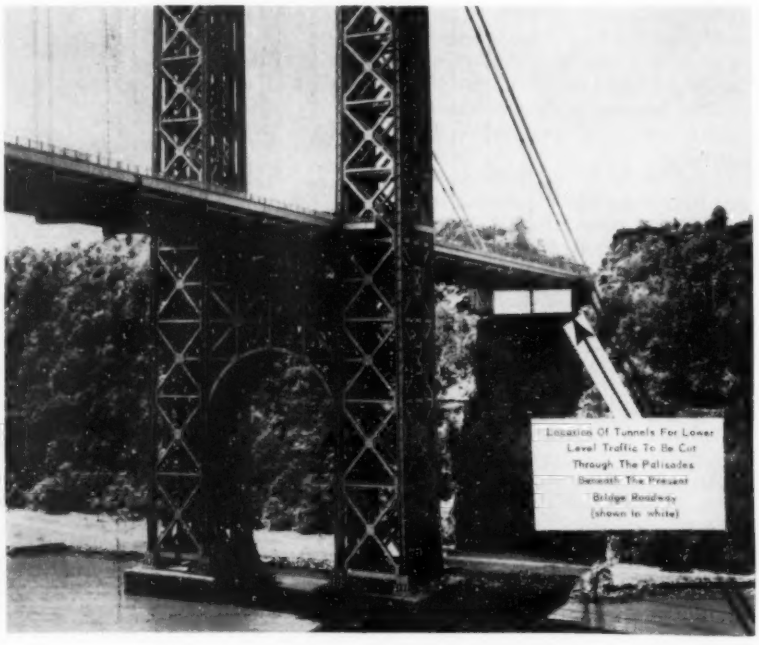
TWO tunnels, each providing three traffic lanes, will be built through the Palisades in Fort Lee, N. J., by the "cut-and-cover" method beneath the present bridge roadway as part of the expanded New Jersey approaches to the $183,000,000 lower level of the George Washington Bridge. Work will begin immediately under a comprehensive $7,840,653 contract for the construction of the lower level approach roadways.

The contract was awarded by the Commissioners of The Port of New York Authority to the low bidder, George M. Brewster & Son, Inc. of Bogota, N. J.

At the same time, the Commissioners awarded a $1,040,250 contract for the construction of the final section of new bridge exit ramps in Manhattan. This contract award was made to Tully & Di Napoli, Inc. of Flushing, Long Island. Upon their completion in the summer of 1960 the new exit ramps will begin carrying upper level traffic to Riverside Drive and the Henry Hudson Parkway.

The contract for lower level approach roadways in Fort Lee includes, in addition to the tunnels, construction of two new bridges on Hudson Terrace to carry north and southbound traffic over the depressed roadways, widening of the north side of the existing main approach bridge over Hudson Terrace, provision of a short emergency ramp from the eastbound lower level roadway to Hudson Terrace and the installation of utilities. Work is expected to be completed in the spring of 1962.

The westbound tunnel (to New Jersey) will be approximately 630 feet long and the eastbound tunnel (to New York) will be about 550 feet long. They will lead to depressed roadways joining the new lower deck with the improved New Jersey bridge plaza.


Location Of Tunnels For Lower Level Traffic To Be Cut Through The Palisades Beneath The Present Bridge Roadway (shown in white)

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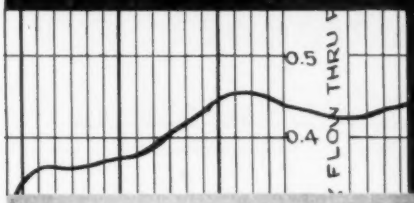

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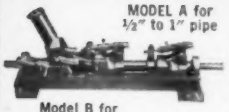
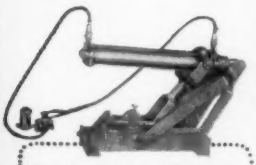


Model B for ¾" to 2" pipe



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1114 Race Drive • Troy, Ohio

Lagoons and Prefabricated Lift Station Used in Sewage Treatment

GEORGE H. RUSSELL,
City Engineer,
Lamar, Colorado

WITH CONSIDERABLE forethought, Lamar, Colo., in 1945, set up a $1 per month sewage use fee to finance future sewage treatment plant construction. As of December 1, 1956, we had $225,000 available for sewage disposal. At this time the $1 fee was cut to 50 cents to cover overall maintenance of sewage facilities.

The City Engineer's office began plans for the treatment plant which was estimated to cost $225,000. These plans were approved by the State Department of Health and a request was then made for the 30 percent grant provided under Public Law 660; and we also requested that we be permitted to do the construction with City personnel. We were allocated $56,454.38 which was not 30 percent of the original estimate, but costs will be adjusted later to a figure that approximates 30 percent. It required some justification to do the work by force account as that was not a normal procedure, but we were in a position to show we had received permission from the Civil Aeronautics Administration to construct our airport by force account and had done so in an efficient and economical manner.

Following considerable investigation and several trips to cities with lagoon-type plants, the City Engineer was instructed to proceed with surveys, plans and specifications for such a plant. Fortunately, an area was available for the lagoon near the point where the outfall line discharges into the Arkansas River, and 150 acres of land were purchased. Plans included constructing 10,000 lineal feet of 24-inch outfall line on a new location, a wet well and lift station, a supplemental water well and three lagoons.

In reading technical magazines considerable data was found on prefabricated lift stations. After discussion with representatives of makers of pumps and of prefabricated stations, it was obvious that, if this type would do the job, there would be a considerable saving in costs. Finally we purchased a prefabricated lift station from Zimmer and Francescon of Moline, Ill., on a bid of $13,263 for a unit equipped with three low-speed 800 - gpm Fairbanks - Morse pumps. This installation will be telemetered from the first lagoon to the Municipal Power Plant. The three pumps are designed to work alternately. In addition we have installed a supplemental water well 66 ft. deep which will deliver 2,000 gpm. This unit will be also controlled by a telemetering system and will eliminate fluctuations in the lagoons due to seepage and evaporation. The lagoons are designed to operate at a 4-foot level which must be closely maintained.

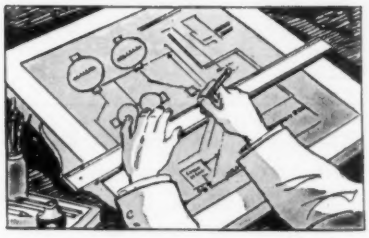
We have 100 acres in three lagoons which are designed to operate in parallel or in series. The force main from the lift station to the lagoons is a 14-in. cast iron pipe line 4000 ft. long. This serves all three lagoons through 14-in. branches which discharge at the center of each lagoon.

The lift station is located 10 feet below the flow line of the Arkansas River, which is 100 feet to the north. Moretrench Corporation contracted for de-watering the job; pumping was as high as 3000 gpm.

The City let the contract for 10,000 lineal feet of 24-inch outfall line to the Valley Concrete Co. of Lamar and Rocky Ford, Colorado, at a cost of $4.55 per lineal foot. The pipe

● **PREFABRICATED lift station is located near the lagoons. Left to right in the excavation are the wet well, lift station and forms for supplemental water well.**

CONSULTING ENGINEERS



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is the No-Joint type of construction which is new to Colorado, but widely used in California.

A Gradall with a semi-circular bucket is used to prepare the trench. Aluminum semi-circular forms with truss type spreaders are used for forming and bracing the inside portion of the No-Joint pipe. An electrically operated machine with a cable operated from a winch which is attached to a trench anchor provides forward motion for the machine. Transit mix concrete with 5½ sacks of Type II cement with admixtures of Pozzolin or PDA of ¼ lb. to the sack per cu. yd. was specified for the pipe.

The Mayor of Lamar is Dr. W. E. Beggs and the Councilmen are A. Roland Green, Fred Felter, Franklin Henry, Herbert Clark, Lewis Horn and W. C. Eddleman.

• • •

Harbor Repair at Long Beach

Long Beach harbor officials have launched a program to stop the gradual sudsidence that has continued for the past 18 years. The sixty-million dollar program is under the direction of Sam Roberts, Subsidence Control and Repressurization Administrator for the Long Beach Harbor, Calif.

Plans call for flooding the city's rich shoreline oil field with sea water which is expected to halt the further sinking of the area. Money will be spent for a system of 259 water wells and a network of miles of pipes leading through much of the 20-square-mile egg-shaped field. Currently the harbor has been sinking at the rate of a foot a year at the center of the oil field. There are 37 water wells in operation now producing 200,000 barrels of sea water a day from underground and for injection into a test field. Ultimate goal to stabilize completely the field and eliminate subsidence is estimated at 1 million barrels of water a day.

It is a critical program advanced in the light of a recent injunction by the government demanding the oil field be shut down and the Navy's announced plan to abandon its $175 million shipyard that lies in the heart of the subsidence area.

Since December, 1936, when the first wells were sunk at Wilmington and Terminal Island, some 800 million barrels of oil have been pumped from this, the nation's second-richest oil field.

It wasn't until 1941 that the roof of the oil field was discovered to be

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sinking, and then the subsidence was only slight.

But the flat-arched, highly-faulted, 8-layer field differs from most. Instead of having thick layers of shale separating each successive oil pool as the earth is penetrated deeper, thin layers of shale, gravel and sand have been encountered. There is nothing to support the overburden.

Present oil production is 80,000 barrels a day from 2,930 wells owned by 121 operators.

The water is injected 2,000 to 5,700 ft. deep into layers of the ground from which oil is removed. The water is pumped from depths of 200 to 300 ft. in the field. This water which seeps in from the sea, naturally filtered by sand beds, is ogygen free, and clear, matching perfectly water found in the oil pools deep in the ground.

It's a twofold program, for injected water not only stops subsidence; it also greatly increases oil recovery. M. A. Nishkian & Co., Long Beach, are the consulting engineers.

• • •

Re-Use of Waste Waters

(*Continued from page* 119)

perience, a modern water purification plant incorporating prechlorination, with generous sedimentation periods, conventionally loaded rapid sand filters and chlorine applied at two intermediate points in the process can be depended upon to remove known bacterial and viral pollutants from sewage-contaminated water. Chlorine residuals of 1 mg/L or more should be maintained in the finished water, and a continuous chlorine recorder is desirable since the chlorine demand may vary considerably in short periods of time.

Walton's studies[5] show that such a plant can treat raw water having a coliform density of 10^6 per 100 ml and consistently produce a coliform-free product. However, treatment which removes all coliform bacteria may not destroy all pathogens. Further studies are needed to confirm the findings at Chanute which show that a rather inadequate plant did remove all pathogenic organisms during the period of study.

The softening process effectively removed the phosphates, but reductions in ABS, COD and nitrogen were much less. Thus the reuse of water for drinking purposes may be as seriously hindered by chemical as by bacteriological considerations, and long storage between periods of reuse becomes more important.

On the basis of the limited experience at Lyndon and Chanute, and the much greater successful experience of cities in treating heavily polluted water, some reuse of water by cities is possible; and the reuse can be undertaken safely. Where this practice is considered, dilution water should be provided in as large amounts as possible. Further studies are needed to show the limitations of such a practice, but in some of the most critically water-short areas of the world, the possibility of reuse cannot be ignored.

Before this method is adopted for drinking water, however, all other possible sources of supply should be exhausted. In addition, industries and users should have adopted water conservation practices which include cooling towers and the use of treated waste water for processes which do not require the higher quality water.

The public health profession holds the key to the question of water reuse; it has the talents and the tools to examine this subject objectively and determine its applications and limitations. Some of the questions raised by these two cases of reuse will be asked again. Public health officials need to conduct the research and studies necessary to provide more of the answers than were available to us in the fall of 1956.

These comments would be incomplete without giving major credit to my associates of the Kans. Board of Health and to the staff of the Robert A. Taft Sanitary Engineering Center at Cincinnati for their major contributions to the investigation at Chanute. Their findings have advanced our frontiers of knowledge in the reuse of water for domestic purposes.

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PUBLIC WORKS
EQUIPMENT NEWS

Ditch Witch trencher for water service lines can be handled by one man

C-3 Trencher for Service Lines

The Model C-3 Ditch Witch trencher announced by The Charles Machine Works features a new positive acting spring loaded clutch which improves ease of handling by the operator. A ball bearing screw jack is used for raising and lowering the digging boom. Standard equipment includes a 2-ft. depth digging chain with a selection of teeth for digging 3, 4 and 6-in. widths. Optional equipment available includes dual wheels, a sod cutting attachment and a lightweight trailer for transporting the equipment. For more details write The Charles Machine Works Inc., 625-30 Birch St., Perry, Okla., or circle **No. 5-1** on the reply card.

Prefabricated Mechanical Street Sweeping

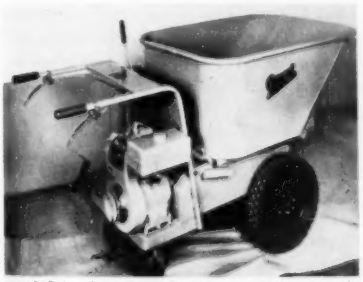
Brooms have been thoroughly tested and are now offered in DuPont's Tynex nylon filament by Rynal Corp. Prefabrication takes the gamble out of pick-up broom production. It permits fast installation, eliminates any lack of uniformity and assures perfect balance. Maximum efficiency and longest possible wear results without waste. For complete details write Rynal Corp., 114 St. Joseph St., Arcadia, Calif., or circle **No. 5-2.**

Machines Designed with Compaction In Mind

Compact and powerful, the Jay J-18 delivers three times the tamping power of the previous J-12. Revolutionary new shoe design and weight ratio, plus improved telescoping shock mounted handle allow this tamper to work harder, faster and with greater operator comfort than ever before. It has been tested through thousands of machine hours on all major soils classifications and density requirements. The J-18 is powered by a Wisconsin 4.6 hp air cooled engine and is equipped with a Jay carburetor. Travel speeds range from 30 to 60 fpm depending on thickness of lift and type of material to be compacted. For complete data write The Jay Co., Columbus 7, O., or circle **No. 5-3** on the reply card.

Power Buggy

Aeroil Products has announced the Model PL-10 power buggy which has a bucket capacity of 10 cu. ft. and will travel at a maximum speed of 5 mph up a 20 percent slope with a 1500 lb. payload. The clutch and brake are operated from one hand lever while the operator has throttle control on the other hand lever. Forward and reverse gears are operated by a foot pedal. The buggy weighs 560 lbs. and is powered by a 6-hp engine. It is equipped with pneumatic tires and two swivel wheels are located in the rear to stabilize turning and provide radius turns. Further information from Aeroil Products Co., Inc., 17 Wesley Street, South Hackensack, N. J., or circle **No. 5-4** on the card.



Weight of power buggy is 560 pounds

Concrete Curing Compound

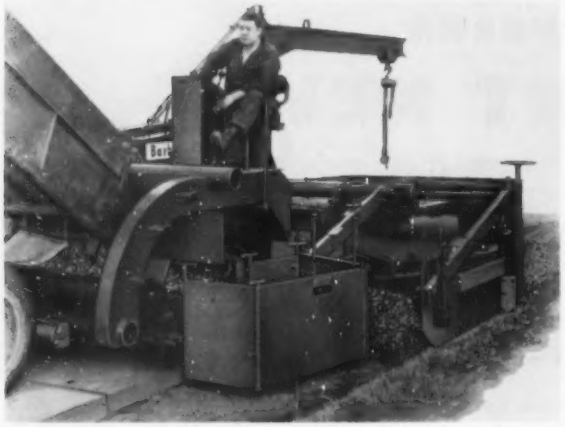
A white pigmented, clear concrete curing compound is announced by Surface Research Corp. The product is available in 55-gallon size drums under the trade name BearCat. It is used on highways and in other concrete construction and is sprayed directly onto concrete surfaces to control the rate of drying and curing to prevent cracking. More data from Surface Research Corp., 2829 East Fourth Ave., Columbus, O., or circle **No. 5-5** on the reply card.

Electronic Distance Measuring Device

Highway departments can save time and money through the use of a Geodimeter

The Model 4 Geodimeter, a distance measuring tool for highway surveying, features lightweight, simplicity and accuracy over distances from 50 ft. to 3 miles. Weighing only 35 lbs. and approximately 12 ins. square, the Model 4 is mounted on a tripod such as is used with theodolites. With only a two man team, the instrument can be used under difficult terrain and weather conditions with ease and accuracy. For detailed information write to The Geodimeter Co., Div., of Berg-Hedstrom, 1170 Broadway, New York, N. Y., or circle **No. 5-6** on the reply card.

Barber-Greene Road Widener



Road widener handles all types of widening jobs and mixes

Offering a completely new concept in solving major problems of road widener design and operation, Barber-Greene's newly announced Model SJ-50 road widener has been engineered to handle all types of road widening jobs and road widening mixes, including soil, concrete, asphalt, stone, stabilized materials, etc. The SJ-50 consists, basically, of two units; a tractor and a trailer. The two are connected by a conventional fifth-wheel arrangement. The tractor includes the operator's deck; the power unit; the drive wheels; the receiving hopper; and discharge conveyor. The trailer, which is equipped with its own jib-hoist, supports the widening attachments during operation and also serves to transport the tractor unit and the attachments when moving from job to job. Ten forward speeds and two reverse allow the choice of the right speed for every type of laying job. A 10½ mph travel speed, combined with extreme maneuverability, gets the machine on and off the job faster. For complete details write Barber-Greene Co., 400 No. Highland Ave., Aurora, Ill., or circle **No. 5-7** on the reply card.

No-Shift Reversing Tractor

Massey-Ferguson Work Bull tractor is entirely new design

An entirely new design in industrial tractor-loaders, the Work Bull 406—featuring instant, no-shift reversing, a torque converter, and five equal speeds in either direction is announced by Massey-Ferguson. The multiple-disc hydraulically actuated reversing clutches provide the no-shift reversing feature—and the 60.3 bare-engine horsepower gives the rig plenty of speed and power. To control directions, the operator depresses the right pedal to go forward and the left for reverse. These foot pedals also control the speed of movement forward or backward. Advanced power steering and a torque converter that adjusts speed to load requirements are among other features of the 406. The 406 has direct-line thrust for bull-dozer type action, and the telescoping lift arms permit 126-in. lift height at the hinge point. The bucket has a payload of ⅞-cu. yd. and a struck capacity of 2/3 cu. yd. Attachments include a pick-up sweeper, rotary broom, angle dozer, fork lift and swinging crane. For full details write Massey-Ferguson Industrial Div., 1009 So. West St., Wichita, Kans., or circle **No. 5-10** on the reply card.

Control Device Turns On Street Lights Automatically

Safer highway lighting is assured by Skywatch, a new product developed for Wheeler - Fullerton Lighting Div. This automatic lighting control device which is adaptable to any street light now in operation, turns on light exactly when needed, day or night. It responds immediately to sky luminosity through a photo-sensitive unit. Ruggedly-built, it is completely shock and vibration proof and is hermetically sealed in a weather proof plastic housing. A miniature neon pilot light indicates correct operation of the photo control. For further information write Wheeler-Fullerton Lighting Div., 275 Congress St., Boston, Mass., or circle **No. 5-8** on the reply card.

New device gives much safer lighting

Flashing Barricades

Four optically perfected 7-in. lens throw twin beams in two directions with brilliant visibility for miles, over 300 sq. ins. of light area. If one light is damaged, the other continues to perform. The vertical barricade with highly reflective scotchlite panel will withstand high winds and rough usage and is fitted with handles that accommodate 2-in. x 4-in. or 2-in. x 6-in. rails for enclosing or fencing. A "sawhorse" type barricade can also be used with the transistor circuit. For more details write Flash Enterprises, Inc., Box 386, Cazenovia, N. Y., or circle **No. 5-9** on the reply card.

Portable Drill for Pavement Test Coring

The Acker Drill Co. has an all new portable drill designed exclusively for pavement test coring. The rig is self-contained, completely portable and trailer mounted to be towed by car, jeep, station wagon or truck. For details write Acker Drill Co., Inc., P.O. Box 830, Scranton 2, Pa., or circle **No. 5-11** on the reply card.

Hydra X Cavator-Crane

All functions which include travel, steering, wheel brakes and attachments are hydraulically controlled from one operator station on the new Model AH-4, one man self-propelled Hydra X Cavator-crane. Simplicity of design, rugged construction and use of heavy duty components, provide easy maintenance and a minimum of service. Its compact size enables it to be operated in the most restricted areas. Low cost end attachments are quickly interchangeable on the same basic boom and dipper stick, and include: backhoe, shovel, clamshell shovel-loader bucket and backfill blade. For complete details write Davis Engineering Inc., Percy St., P. O. Box 127, Dowagiac, Mich., or circle **No. 5-12** on the reply card.

Larger Capacity Sealed Register Water Meter

A ¾-in. magnetic drive sealed register water meter, with a capacity of 30 gpm has been announced by Rockwell Mfg. Special features are: 1) a hermetically sealed register to end the problem of dirt, water and condensation that fogs dials; 2) a powerful magnetic drive which eliminates the need for a stuffing box, an exposed intermediate train and a driving dog; and 3) the proven oscillating piston principle for long life and accurate measurement. The entire unit contains 15 stock parts, of which only two moving parts operate in contact with water. Straight reading registers calibrated in cubic feet or gallons with a center sweep-hand are furnished. For further information write Rockwell Mfg. Co., Municipal and Utility Div., 400 North Lexington Ave., Pittsburgh 8, Pa., or circle **No. 5-13** on the reply card.

Meter contains only 15 stock parts, of which only 2 operate in the water

Gar Wood Introduces New Load-Packer

A new Gar Wood Load-Packer, the "600" series, has been announced by Gar Wood. The refuse collection unit incorporates a number of new mechanical features including a telescopic hoist that does not require a hoist sub-frame; simplified controls; an exceptionally efficient hydraulic system; and a large 1½-cu. yd. hopper. Once the hopper is filled, the cycle begins when a rotary loading panel sweeps the load into a loading position. Here, the refuse is packed toward the front of the body by direct thrust compaction compressing it under tons of pressure into a voidless load. The entire cycle takes only ten seconds. The short cycle, under automatic solenoid speed, reduces fuel consumption substantially. More details from Gar Wood Industries, Inc., Wayne, Mich., or circle **No. 5-14** on the reply card.

Oliver Crawler Tractor with "Spot-Turn" Clutch Steering

Major advances in crawler tractor maneuverability and operating safety have been achieved by Oliver with the development of "Spot-Turn" clutch steering. The "Spot-Turn" mechanism is available in the OC-4 and its companion model, the OC-46, which basically is a heavy duty ⅝-yd. loader. Both models are rated at 30 engine hp. "Spot-Turn" clutch steering eliminates the necessity of foot braking for tractor guidance, enabling the operator to make locked-track, partial or wide turns with single-lever control. Cross steering is never required when going downhill or when the tractor is being pushed by a load and when dozing with the corner of the blade, the tractor will not drift toward the load. Matched allied equipment is available for grading, backfilling, leveling and terracing, scarifying, trenching, lifting, posthole digging and similar jobs. More details from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O., or circle **No. 5-15.**

Powr-Pactor Now Available With Electric Motor Drive

The Maginnis self-propelled vibratory compactor can now be supplied with a 3 hp, 110/220/440-V, 60-cycle, 3,450-rpm, single or three-phase electric motor in place of the usual gasoline engine and clutch. The unit has a fixed vibrating frequency of 6500 vpm and a compacting force of 4,000 lbs. It will travel up to 50 fpm. Damping springs isolate the 12-in. x 18-in. compacting plate from the rest of the machine. Two dolly wheels facilitate moving it into place and out of corners. A water feed attachment and wide rim steel rollers in place of the dolly wheels are available for hot-mix asphalt applications. Two or more units can be ganged side by side for compacting larger areas, or in tandem for trench work. For complete data write Maginnis Power Tool Co., 154 Distl Ave., Mansfield, Ohio, or circle **No. 5-16** on the reply card.

All-Around Digging and Loading Tool

Addition of a new No. 933 Series F Traxcavator to its line has been announced by Caterpillar. Features of the machine are a completely new engine; new, stronger power train; larger-capacity bucket; and an operator's compartment built for maximum comfort. The new 4-cylinder engine is rated at 52 flywheel hp. With a reverse speed of 3.67 mph, the No. 933 Series F offers faster cycle times and more economical production. A 1⅛-yard heavy-duty bucket is standard and, to facilitate easier operation in demanding terrain, ground clearance is 12½ inches. More data from Caterpillar Tractor Co., News Service, Peoria, Ill., or circle **No. 5-17.**

Traxcavator has 1⅛ cu. yd. bucket

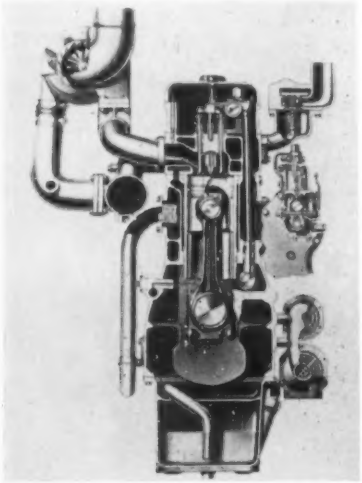
Flaherty Self-Propelled Power Broom

Flaherty power broom is operated by one man and is equipped with built-in blower

A new self-propelled power broom named the Broom-Master is announced by Flaherty Mfg. The machine with built-in blower and one-man operation provides speed, maneuverability and reduced operating expense. The blower applies a full broom-width jet air stream at the right place and, in conjunction with the rotation and suction of the broom core, does an effective job. A unique design feature allows the blower to be held in the desired position as adjustment is made to compensate for broom core wear. Other design features are: Positive broom setting; and ampli-torc drive, which permits high or low speed range in each of 6 gears (5 forward and 1 reverse) providing a choice of 12 working speeds. A 240-gal. water tank is built integrally with the frame. An easy-to-change 8-ft. moldboard blade attachment is available and this makes it a much more valuable, highly versatile, utility machine—ideal for light construction and maintenance work. For data write Flaherty Mfg., Inc., Pocatello, Idaho, or circle **No. 5-18.**

385 HP International Diesel Power Unit

A new diesel power unit, the International UDT-817, is a six-cylinder, turbocharged, four-cycle unit, with a 5⅜-in. bore and a 6-in. stroke. It displaces 817 cu. ins. and has a compression ratio of 16:1. The turbocharged model is rated at 385 maximum hp at 2,100 rpm. With many new design parts and systems, the high-output, heavy-duty engine is engineered for application in all types of construction equipment, including rubber-tired earthmoving machinery, off-highway haulers and large on-highway trucks. For complete details write Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 5-19** on the reply card.



Cutaway view of IHC 817 diesel engine

High Cycle Concrete Vibrator Weighs 43½ Pounds

A high cycle concrete vibrator utilizing a rotary centrifugal eccentric is now available from Dart Mfg. Designated the DHC-300 "Texan", this 43½-pound vibrator has a head length of 21 ins. and a diameter of 4 ins. It was developed especially for continuous service on big jobs where pours are deep and aggregate is large. It operates on 180-cycle current and is available in either 115 or 230 volts. The rpm under full load at 183 cycles is 10,800. It may be operated on a 3 KW generator or used in gangs for big screeding operations with a larger generator. Complete details from Dart Mfg. & Sales Co., 1002 South Jason St., Denver 23, Colo., or circle **No. 5-20** on the reply card.

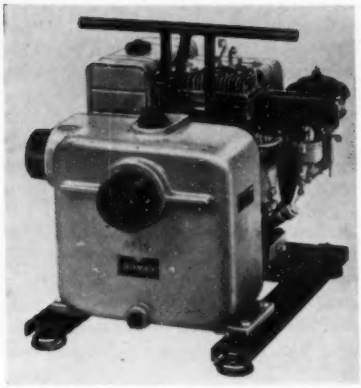
Melting Kettle

Hauck Mfg. has developed the "E-Z-Loader" kettle, Series KT, for melting tar, asphalt, pitch and bituminous compounds. The heavy duty heating system has center tubes which are of ¼-in. thick seamless steel for extra long service and are shaped to conform to the new kettle contours. The inside kettle is all-steel welded construction and shaped for fast, easy cleaning. The extra heavy concealed chassis frame, of 4-in. channel iron, is directly connected to the inner shell. 1½-in. Fiberglas kettle insulation keeps the heat inside the kettle. A built-in heat riser speeds morning melt in a cold kettle by releasing the pressure of hot gas and liquid that develops around the tube areas. Trailer type kettles on pneumatic tires are available in 60, 90, 120, 180, 240 and 360-gal. melting capacities. Skid type kettles, with convenient sliding carrying handles for easy truck loading or moving, are made in 60, 90 and 120-gal. capacities. Complete details from Hauck Mfg. Co., 124-36 Tenth St., Brooklyn 15, N. Y., or circle **No. 5-21** on the reply card.

Semi-Hydraulic Vertical Auger Drill

Drill is adaptable to most tractors

This auger drill, announced by J. R. Prewitt, is adaptable to most industrial wheel and crawler tractors. The digger can bore to 60 ft. with augers of 3, 4 and 6-in. diameter; and with 12, 14, 16, 18 and 20-in. diameter augers, it can bore 6½ ft. Augers are rotated by mechanical drive from tractor PTO. Two hydraulic operated outriggers are used for leveling and stabilizing. For full details write J. R. Prewitt & Sons, Pleasant Hill, Mo., or circle **No. 5-22** on the reply card.



3-in. pump weighs less than 100 lbs.

3-in. All-Aluminum Pump

A 3-in. pump, with a four-cycle engine, weighing less than 100 pounds, is now available from Midland Products. The all-aluminum pump has a capacity rating of 18,000 gph. A 2-in. pump with a rating of 12,000 gph is also available. All wearing parts of these pumps are easily and inexpensively replaced without the necessity of replacing any main castings. For detailed information write Midland Products Co., Midland Park, N. J., or circle **No. 5-23** on the reply card.

Level Control for Bulk Bins

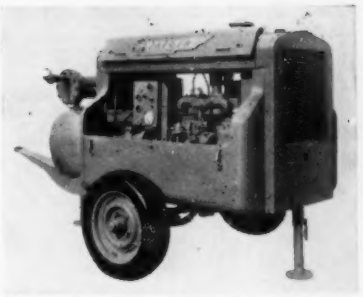
A new Bin-Vue level indicator and control which features an easy-off cover and a fail safe device has been announced by Convair. Access to the unit is gained by simple push-up, push-down and pull-off motion on the single-piece cover. The cover is held in place by compression of an "O" ring on the mounting flange. A limit switch, acting as a fail safe device, is activated 18 times a minute and can be connected for visible or audible control. In operation, a 1/100 hp motor turns a four blade paddle at 9 rpm by means of a torsion spring. The paddle turns continuously as long as no material touches it. When material makes firm contact with the paddle, the paddle stops. The motor continues to run, turning the spring until it activates a limit switch. The switch kicks off the motor and any other equipment connected to the indicator. When the material falls away from the paddle, the torsion spring reactivates the paddle and, in so doing, unwinds from the limit switch, starting the motor and putting the entire unit in operation again. For full details write Convair, Inc., P. O. Box 9671, Pittsburgh 26, Pa., or circle **No. 5-24** on the reply card.

Traction Equalizer Announced by Rockwell-Standard

Of interest to operators of both off-the-highway and over-the-highway units is a new traction-improving device announced by Rockwell-Standard. Known as the Rockwell Traction Equalizer, it imparts to the wheel with the best road adhesion a substantial increase in tractive effort. So effective is this new device that it will propel a vehicle even if one of the driving wheels is completely off the ground. Because the unit is continually engaged and doesn't depend on the driver for activation, it is automatically effective whenever one wheel tends to turn faster than the other. With multi-drive axle vehicles, each axle may be equipped with the unit. Simplified maintenance is claimed for the unit which is self-lubricating. For complete details write Rockwell-Standard Corp., Transmission and Axle Div., Detroit 32, Mich., or circle **No. 5-25** on the reply card.

75 cfm. Rotary Compressor

A 75-cfm rotary air compressor is being offered by The Jaeger Machine Co. Because of rotary design, it has fewer moving parts, is completely vibration-free and delivers 75 cfm of air at constantly maintained 100 lbs. pressure. It has the capacity to run a heavy duty 80-lb. paving breaker at top efficiency, maintaining 90 lbs. working pressure at the tool. It is oil-cooled, powered by a Continental F140 gasoline engine and has a full load speed of 1750 rpm. Simple, instant-acting precision controls insure constant air pressure under all normal demands and positively prevent over-run and engine racing. For complete information write The Jaeger Machine Co., 550 West Spring St., Columbus 16, O., or circle **No. 5-26** on the reply card.



Jaeger Machine rotary air compressor can deliver 75 cfm of air at constantly maintained 100 pounds per sq. in.

All-Wheel Drive Austin-Western Motor Graders

Two new all-wheel drive and steer power graders, the Pacer-200 and the Super-200 are announced by Austin-Western. The Pacer-200 is a four-wheel machine. The Super-200 is a six-wheel model. Both machines have a basic weight of 20,000 lbs. Front and rear power steering and full hydraulic control are standard features of the machines. They are equipped with 106-hp GMC diesel engines and power train options permit a choice of dry clutch or torque converter and either four-speed or six-speed transmissions. An hydraulically operated power-tilt mold board is an optional feature. With the new machines there are now six power graders made by Austin-Western. The others are the Pacer-100, Super-100, Pacer-300 and Super-300. These, formerly known as the 88- and 99-series graders, were renamed for purposes of nomenclature consistency. For complete data write Austin-Western, Box PW, Aurora, Ill., or circle **No. 5-27** on the reply card.

Power grader with six-wheel-drive and six-wheel-steer is made by Austin-Western

New Deepwell Turbine Pump

Construction details of the oil-lubricated Byron Jackson deepwell turbine

Called the Type G, the new deepwell pump, announced by Byron Jackson, is designed for widespread general application by municipalities and other primary water supply users. A major design improvement in the oil-lubricated Type G series is a new, extra-long, one-piece throttle bushing that serves both as a bearing and a by-pass seal. Extending from the top case down into the first series case, the "Aqua-Flo" bushing eliminates troublesome top-case packing and prevents sand from entering the bearing surfaces. Collet-type impeller mountings are another major design innovation on all Type G pumps. The new type construction makes assembly and disassembly of BJ pumps easier and faster and results in a secure, positive mounting. Also featured is a new stuffing box assembly that consists of a combination bearing and tension nut that effects a permanent seal at the driver head and also holds the head shaft in correct running alignment. A choice of impellers for both medium and high-capacity performance in every Type G bowl size are offered. The two impellers are interchangeable without alterations of any kind, permitting selection for a wide range of operation. For complete data write Byron Jackson Pumps, Inc., P. O. Box 70, Lawrenceburg, Ind., or circle **No. 5-28** on the reply card.

Earthmoving Attachments for Ford Tractors

Five new attachments for handling materials and earthmoving jobs are announced by Tractor and Implement Division, Ford Motor Co. These include a new Ford rear-mounted reversible scoop, universal dozer blade, a new Dearborn scraper, landscaper and earthcavator. The scoop attaches to the rear three-point implement linkage of any Ford tractor and carries up to 10 cu. ft. of earth or other material. Both 6 and 7-ft. universal dozer blades for use with the line of Ford loaders are now available. Two new attachments to be used in conjunction with the dozer blades are a blade angle adapter which permits the blade to be kept straight or angled to any of three positions to the right or left. For snow removal work, a spring release is available which attaches to the angle adapter and allows the top of the blade to tilt forward, permitting the cutting

Dearborn excavator with Ford tractor

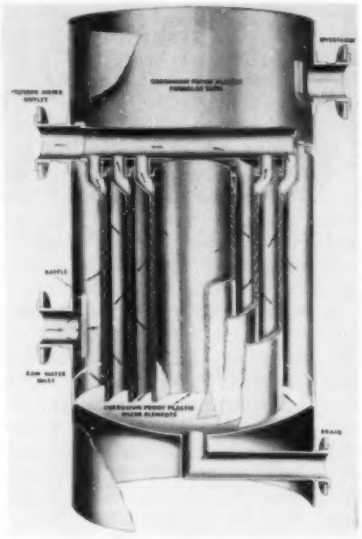
edge to slide over solid obstructions. The 65-in. Dearborn scraper and 65 and 72-in. landscapers are rear-mounted box type scrapers with side plates, scarifying teeth, and a hinged blade for backfilling. The Dearborn earthcavators of 65 and 72 ins. for use with Ford tractors and an 80-in. model for the Fordson Major Diesel tractors are rear mounted scrapers with scarifying teeth. Complete details from Public Relations Dept., Tractor and Implement Div., Ford Motor Co., Birmingham, Mich., or circle **No. 5-29** on the reply card.

Factory-Made Joints for Large Size Pipe

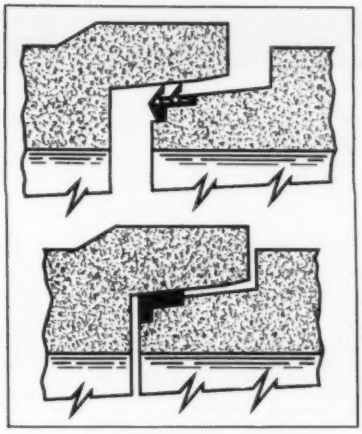
All of the advantages of factory-made, compression joints for vitrified clay pipe are now available, for large size pipe with the introduction of a new Speed-Seal joint by Gladding, McBean & Co. The new joint is designed for use in all large diameter (15 through 42-in.) sanitary sewer line installations. The compression feature of the new joint is accomplished by embedding a flat surface rubber gasket in a polyester casting on the interior surface of the bell. A uniform sealing surface is made by casting polyester on the spigot end of the pipe. Both components are factory applied. The new joint is especially suited for installations requiring a high degree of flexibility, high standards of exfiltration and infiltration, and assured resistance to root penetration. The company also makes Speed-Seal plastisol joints in smaller diameter (4 through 15-in.), and these are factory-made compression joints of the Wedge-Lock design. For complete data write Gladding, McBean & Co., 2901 Los Feliz Blvd., Los Angeles 39, Calif., or circle **No. 5-30** on the reply card.

All-Plastic Vacuum Filter for Swimming Pools

A cylindrical, more compact, all-plastic swimming pool filter has been introduced by B-I-F Industries. The new vacuum filter is constructed entirely of corrosion-resistant materials, eliminating special liners and annual paint maintenance. It is made in seven sizes, from 45 sq. ft. up to 465 sq. ft. It is designed for municipal, institutional and commercial swimming pools, ranging upward from 45,000 gallons. All external construction is corrosion-resistant fiberglas reinforced plastic, including the filter shell, inner elements and baffles. The concentric elements are made of woven plastic and covered with fine mesh polyethylene sleeves, promoting the smooth buildup of filter aid. Further details from B-I-F Industries, Inc., 345 Harris Ave., Providence 1, R. I., or circle **No. 5-31** on the reply card.



Vacuum filter is made in seven sizes



Gaskets for Concrete Pipe

Tylox C-P and C sewer pipe gaskets have been announced by Hamilton Kent. The gaskets are designed for concrete pipe of all sizes, with single or double offset, and provide true compression, flexible, leakproof joints capable of withstanding head pressures up to 50-feet. They may be made of either rubber or neoprene, and can be applied to pipe at the job site, or the pipe manufacturer's plant. It is properly applied and ready for coupling on offset bell and spigot pipe. The gaskets consist of base, multiple sealing fins and inspection flange which overhangs the edge of the pipe tongue, or alternately, the tongue offset, according to the type of pipe used. Complete details from Hamilton Kent Mfg. Co., 427 West Grant St., Kent, Ohio, or circle **No. 5-32** the reply card.

Surface Wash Baffles

Filtration Equipment Corp. has announced the development of Feco Lightning surface wash baffles for rapid sand filters. With this new development it is possible to produce a clean filter bed in half the backwash time. Extensive tests on rapid sand filters indicate that a uniform backwash of 15 gpm per square foot (24″ rise) produces sufficient agitation to separate the dirt from the sand grains, without the use of additional mechanical surface wash facilities. The baffles consist of boatlike units which rest on the edges of adjacent wash troughs and may be easily installed or removed from the filter to inspect the sand bed. They are made from asbestos cement sheets in units approximately four feet long. Complete details from Filtration Equipment Corp., P. O. Box 1331, Rochester 3, N. Y., or circle **No. 5-33** on the reply card

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

PROFESSIONAL OPPORTUNITY

The Department of Sanitary Engineering of the District of Columbia is accepting applications for the positions of Sewage Treatment Plant Shift Superintendents.

Desired qualifications include college degree in sanitary or civil engineering and previous experience in sewage treatment plant operation. The starting salaries for these positions are $4,490 to $7,510, depending on experience.

This is a Civil Service position as a Shift Superintendent in a high-rate activated sludge treatment plant of a design capacity of 290 mgd. Benefits include paid annual leave and sick leave, group insurance, retirement and other employee benefits.

Those interested may send a complete summary of education, experience and personal data to Mr. Hugh A. Schreiber, Superintendent, D. C. Sewage Treatment Plant, 5000 Overlook Avenue, S. W. Washington 24, D. C.

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Two 500 G.P.M. 4″ x 4″ American Well Centrifugal Service Pumps 1760 R.P.M.

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INDEX OF ADVERTISEMENTS

Acker Drill Co., Inc. 166
Alabama Pipe Co. 90
Allis-Chalmers ..... 16 & 17
Construction Machinery Division
Aluminum Company of America .... 56 & 57
Amercoat Corporation 63
American Bitumuls & Asphalt Company .. 167
American Bridge Division ..... 28 & 29
of United States Steel
American-Marietta Company 23
Concrete Products Div.
American Photocopy Equipment Co. 69
American Pipe & Construction Co. 15
American Playground Device Co. 203
American Steel & Wire Division 96
of United States Steel
Anthracite Equipment Corp. 149
Armco Drainage & Metal Products, Inc. .. 32
Asplundh Chipper Co. 149
Austin-Western 168
Construction Equipment Division
Ayer-McCarel Clay Co., Inc. ..... 26 & 27

B-I-F Industries, Inc. 72
B/W Controller Corp. 38
Badger Meter Mfg. Company ..... 84 & 85
Baldwin-Lima-Hamilton 168
Barber-Greene Co. 21
Baughman Mfg. Company 36
Blaw-Knox Company ..... 44 & 187
Blaw-Knox Equipment Division
Bowerston Shale Co. ..... 26 & 27
Brooks Chemicals, Inc. 79
Bucyrus-Erie Company 155
Buffalo Meter Co. 93
Buffalo Pipe & Foundry Corp. 186
Byers Company, A.M. 43

Cannelton Sewer Pipe Co. ..... 26 & 27
Case Company, J. I. ..... 58 & 59
Cast Iron Pipe Research Assoc. .... 10 & 11
Caterpillar Tractor Co. 4
Caterpillar Tractor Company 80
Engine Division
Chicago Bridge & Iron Co. ..... Third Cover
Chicago Pump Co. ..... 3 & 193
Clark Company, H. W. 191
Clark-Wilcox Company 149
Natco Division
Classified Ads 217
Cleveland Trencher Company 18
Cloroben Chemical Corp. 88
Columbia-Geneva Steel Division 96
Columbia-Southern Chemical Corp. 147
Combustion Engineering 157
Continental Motors Corp. 64

Darley & Co., W. S. 172
Deere, John 169
Industrial Division
Dempster Brothers 66
Diamond Alkali Company 165
Dicalite Department 184
Great Lakes Carbon Corp.
Dickey Clay Mfg. Co., W. S. ..... 26 & 27
Douglas Fir Plywood Association .. 82 & 83
Dow Chemical Company 14

Eaton Manufacturing Company 97
Axle Division
Eimco Corporation 22
Essick Mfg. Company 74

Filtration Equipment Corp. 198
Fitchburg Engineering Corp. 55
Flex-O-Lite Mfg. Company 25
Flexible Inc. 194
Flynn & Emrich Co. 48
Ford Motor Company ..... 30 & 31
Ford Motor Company ..... 19 & 20
Tractor & Implement Division
Forney's Inc. 162

Galion Iron Works & Mfg. Co. .. Second Cover
Gar Wood Industries, Inc. 144
Gorman-Rupp Company 188
Grace Sign & Mfg. Company 200

Hamilton Kent Mfg. Co. 45
Hersey Manufacturing Co. 33
Highway Equipment Company 163
Holan Corporation 100
Subsidiary of The Ohio Brass Company
Hotel Jefferson 198
Hough Company, Frank G. ..... 70 & 71
Huber-Warco Company ..... 8 & 9
Hydepak Division 159
Hobbs Trailers
Hydrauger Corp., Ltd. 38

Ingersoll-Rand 189
International Harvester Company 13
Iowa Valve Company 179

Jaeger Machine Co. ..... 158 & 197
Johns-Manville ..... 86 & 87
Josam Mfg. Company 92

Kaiser Aluminum & Chemical Sales, Inc. .. 39
Keasbey & Mattison Company 60
Kelley Machine Division 199
The Wiesneer-Rapp Co., Inc.
Keuffel & Esser Company 51
Kohler Company 180
Komline-Sanderson Engineering Corp. 68 & 158

Leopold Co., Inc., F. B. 220
Leupold & Stevens Instruments, Inc. 203
Link-Belt Co. 47
Lock Joint Pipe Co. 73
Ludlow Valve Mfg. Co. 183

M-B Corporation ..... 166 & 195
M & H Valve & Fittings Co. 52
Massey-Ferguson Industrial Division 35
McConnaughay Mixers, Inc. 170
Meadows, Inc., W. R. 174
Measure-Rite, Inc. 78
Minnesota Mining & Manufacturing Co. .. 173
Miro-Flex Co., Inc. 148
Morton Salt Company 77
Mott Corporation 160
Mueller Co. ..... 37 & 181
Multiplex Manufacturing Company 197
Myers & Bro., Company, F.E. 94

Natco Corp. ..... 26 & 27
National Clay Pipe Mfrs. Inc. 12
Neenah Foundry Company 196

Oliver Corporation 67

Pacific Flush Tank Co. 153
Pacific Mercury 42
Palmer Filter Equipment Co. 200
Pfaff & Kendall 151
Pomona Terra-Cotta Co. ..... 26 & 27
Portland Cement Association 171
Pratt Company, Henry 75
Preload Company, Inc. 198
Press-Seal Gasket Corp. 41
Prewitt & Sons, J. R. 42

Rensselaer Valve Mfg. Co., Inc. 183
Roberts Filter Mfg. Co. 172
Rockwell Mfg. Company 185
Roots Connersville Blower 53
A Division of Dresser Industries, Inc.
Rust-Oleum Corporation 61

Seaman-Andwall Corporation 81
Sherman Products, Inc. 65
Sika Chemical Corporation 180
Simplex Valve & Meter Co. 95
Smith & Company, Inc., Gordon 146
SOHIO 175
Sperling Meter Company 49
Sumo Pumps Inc. 154
Sparkler Mfg. Company 182
Stanco Mfgs. & Sales Inc. 50
Standard Dry Wall Products, Inc. 76
Standard Steel Works, Inc. 176
Syachro-Start Products Inc. 40

Tarrant Manufacturing Co. ..... 46 & 150
Taylor & Co., W. A. 62
Tennessee Coal & Iron Division 96
Texas Vitrified Pipe Co. ..... 26 & 27
Todd Shipyards Corporation 156
Products Division
Tractomotive Corporation 89
Trickling Filter Floor Institute ..... 26 & 27
Trojan Division 161
The Yale & Town Mfg. Co.
Trojan Mfg. Co. 203

Union Metal Mfg. Company 91
U.S. Rubber Reclaiming Co., Inc. 172
United States Steel Export Company 96

Vermeer Manufacturing Company 199
Vibro Plus Products Inc. 177

Wallace & Tiernan Co., Inc. ..... Back Cover
Washington Aluminum Co., Inc. 46
Waukesha Motor Company 6
Western Machinery Company 156
Westinghouse Electric Corporation .. 98 & 99
Weston Co., L. A. 162
West Side Iron Works, Inc. 150
Wilkinson Products Company 40
Wisconsin Motor Company 54
Wyandotte Chemicals 24
Michigan Alkali Division

Yale & Towne Manufacturing Co. 161

CONSULTING ENGINEERS APPEAR ON PAGES 205 to 210

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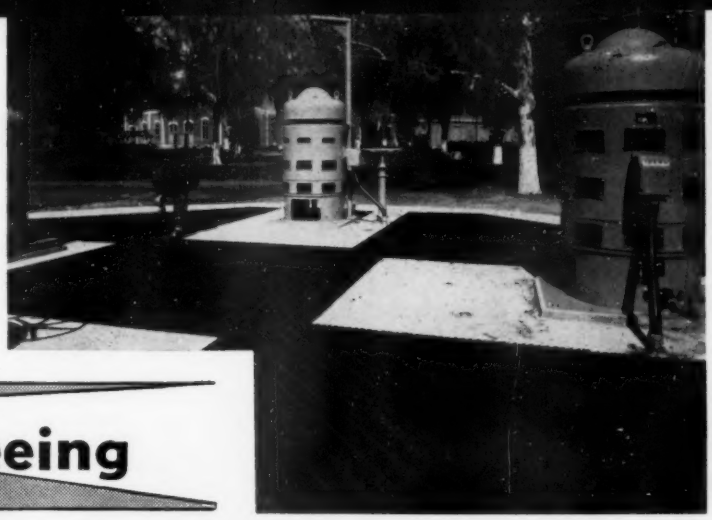
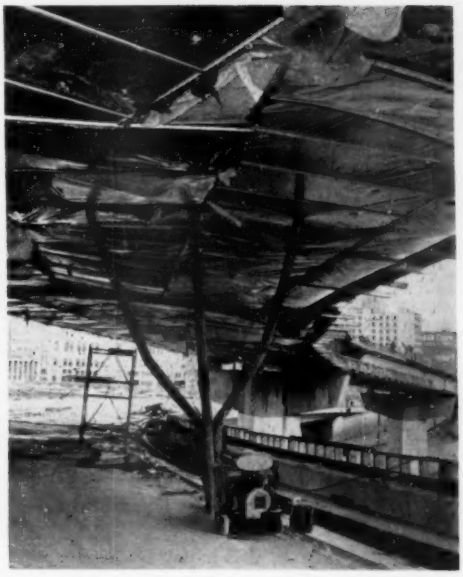


Maintenance personnel of this booster pumping station of the Charleston, S C., water system like the easy-to-see-through feature and quick access afforded by the Blaw-Knox electroforged steel gratings. The non-skid open flooring surrounds four 25 mgd pumps. System serves 30,000 municipal accounts and also supplies water to a pulp processing firm.

—Worth Seeing

World's highest (700 ft.) steel arch bridge spans Glen Canyon on the Colorado River near site of the Glen Canyon Dam. Photo shows International truck and TD-24 tractor crossing the roadway.



Tough, airtight Koppers polyethylene film protects freshly poured concrete on this approach to the Fort Pitt bridge. When temperatures fall below freezing, portable ground heaters warm interior.

38 years of service are behind this Hersey disc meter. Though encased in a tree root, meter was in good operating condition. Shown are Francis P. Hersey, vice pres; Walter A. Hersey, board chairman; Gordon A. Dillon, and J. S. O'Reilly, Hersey's N. E. sales manager.

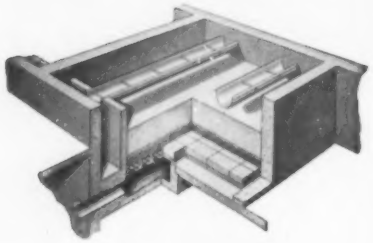
"Back to the salt mine" is not really bad, as conditions in this new Fairport (Ohio) mine of Morton Salt Co. attest. The tunnels will extend under Lake Erie to tap estimated reserve of 200 million tons.

Leopold

GLAZED TILE

FILTER BOTTOMS

Successfully meet all underdrain requirements



Filter unit showing Leopold Filter Bottom and Leopold Fiberglass-Reinforced Plastic Wash Troughs

Performance Proved in over 375 plants with a daily capacity of more than 2¾ billion gallons!

In this design, laterals and distributing blocks form a permanent unit that assures equal filtration and uniform wash distribution with low loss of head. Made of de-aired fire clay—vitrified and salt glazed—the blocks can't corrode, won't absorb water, are acid and alkali resistant, and are not subject to tuberculation.

In addition, the Leopold Filter Bottom needs only a shallow depth of small-sized filter gravel, does not require supporting concrete structures, and is the only design providing a fixed and controlled secondary backwash.

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Exclusive Canadian Representative:
W. J. Westaway, Ltd., Hamilton, Ontario

by Arthur K. Akers

★ **Roderick Ellis** is assuming charge of the Mid-Atlantic territory advertising sales for PUBLIC WORKS Publications, with headquarters in Philadelphia. He has been promoted from the Chicago office of PUBLIC WORKS.

★ **Graver Tank & Mfg. Co.** opens a new district sales office in Seattle and promotes **Richard E. Kimball** from East Chicago to manage it.

★ In March we lost our way among the associations and ascribed the public relations appointment of **J. Walter Thompson Co.** to the **Cast Iron Pipe Research Association.** It should have read **Water and Sewage Works Manufacturers Association.** But we stand by our designation of progressiveness to the former, too!

★ **Miss Marjorie L. Congleton** becomes assistant to the managing director, **Concrete Pipe Associations, Inc.,** Chicago, as well as the **American Concrete Pipe, the American Concrete Pressure Pipe** and the **American Agricultural Pipe Associations.**

★**U. S. Pipe and Foundry Co.** retirements include **Howard A. Hoffer,** export sales manager, and **William E. Schmidt,** Cincinnati sales.

★ **Stuart Corporation,** Baltimore, adds **John T. Behm** to its sales engineering department. Mr. Behm was formerly with Whitman, Requardt & Associates, consulting engineers, Baltimore.

★ **Herman R. Brown** is appointed sales manager "PAYLOADER" Division, **The Frank G. Hough Co.,** Libertyville, Ill.

★ **W. L. Nopper** becomes district manager, New York sales office, **Roots-Connersville Blower Division,** Dresser Industries.

★ **Water Utility Executive's Community Relations Portfolio** is the title of a handsome binder and contents prepared by the **Cast Iron Pipe Research Association,** Chicago. Many helpful public relations ideas are contained in it.

★ **Everett M. ("Casey") Jones** has been named assistant to the vice president of **Rockwell Mfg. Co.,** Meter and Valve Division. He was formerly vice president and general manager of **Simplex Valve and Meter Co.** Other **Rockwell** news is, **James R. Dickerson,** sales manager of the new Western District Municipal and Utility Division; and **Marc D. Gilbert,** assistant to midwestern regional manager, Meter and Valve Division.

Mr. Jones

Mr. Koehler

★ **Richard H. Koehler** has been appointed general sales manager of the **LeRoi Division** of Westinghouse Air Brake Co., at Milwaukee. He has been on the staff of the president of the parent company in Pittsburgh, and will now direct sales for all products of the division from Milwaukee.

★ **Frank Marold,** well-known in the cast iron pipe industry, is named vice-president, sales, of **Griffin Pipe Division,** subsidiary of **American Steel Foundries,** who announce building of a Delavaud process cast iron pipe foundry, scheduled to begin production in Council Bluffs, Iowa, in March of 1960.

★ **The Portland Cement Association** opens a new district office in Phoenix, Ariz., and names **Thomas E. Long,** eastern regional manager in New York.

★ Obituaries this month include **Gary F. Davis,** sales manager, **Ernest Holmes Co.,** Chattanooga; and **Charles F. Boyd,** vice-president, sales, **Galion Iron Works and Mfg. Co.,** Galion, Ohio.

★ **Woman Motorist:** "The thing I hate most about parking is that noisy crash."

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These two 2,885,000 gallon CB&I-built reservoirs serve the Yuma, Arizona, Water Works.

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- *CB&I Tanks give you the tangible economy* of trouble-free service life . . . which steel tanks historically provide.
- *CB&I Tanks give you the protection of a code* for maximum safety which is unobtainable on any other type of construction.

These protective assurances are yours with the purchase of a durable, bottle-tight CB&I steel tank or reservoir. Think it over and we believe you'll agree . . . *Your community is safer with steel.*

M58B

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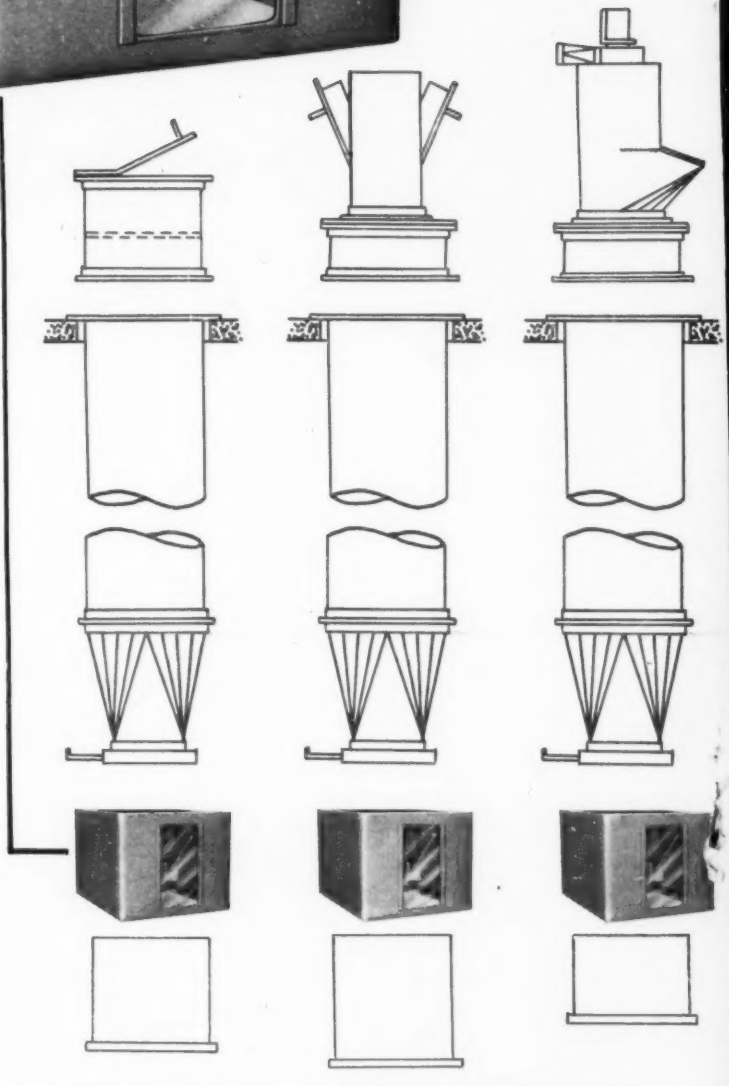

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